SURGERY
GYNECOLOGY AND OBSTETRICS
An International Magazine, Published Monthly

VOLUME 65 AUGUST, 1937 NUMBER 2

PREGNANCY COMPLICATING BONE TUMORS

LEON S. McGOOGAN, A.B., M.D., Omaha, Nebraska

IN THE last few years 10 instances of bone tumors complicating pregnancy have been observed. Literary research has revealed widely scattered references, and isolated case reports of this interesting subject, but there has been no comprehensive review of the entire problem in the last 50 years. As material was assembled it naturally divided itself into the following subheads: (a) the effect of pregnancy upon neoplasms in general; (b) the effect of pregnancy upon bone metabolism; (c) the effect of pregnancy upon bone tumor; a review of the literature; presentation of cases; and discussion of each group.

THE EFFECT OF PREGNANCY UPON TUMOR GROWTH

Emge has reviewed this problem. He observed the growth of neoplasms in the pregnant and non-pregnant animal comparing one with the other. He concluded that the growth of neoplastic tissue will be affected by a pregnancy only as that tissue is affected by the local and remote bodily changes incident to pregnancy, i.e. changes incident to increased blood vascular supply and hormonal stimuli, the ultimate result depending upon the duration of gestation; that pregnancy as a rule does not influence growth rate or size of neoplasms beyond certain reactions of which retardation is the most frequent; that in many instances the growth rate remains unaffected and only on rare occasions is acceleration observed; and finally that at the termination of pregnancy the neoplastic tissue resumes its primary growth rate.

It has not as yet been proved that pregnancy favors the inception of malignant degeneration of tumors.

In his extensive review, Emge mentions many types of tumors, but he does not mention tumors of the bones. It can be assumed, however, that his conclusions would be applicable to bone tumors. The growth of neoplastic tissue, therefore, in or of the bones, primary or metastatic would be "affected by a pregnancy only as that tissue is affected by the local and remote changes incident to pregnancy." Included in this group of reactions would be: (1) increased vascularity in the pelvis and breast, affecting tissues in these areas; (2) changed hormonal activities, hence bony tissue sensitive to hormonal stimuli would show growth changes; and (3) as the metabolism of bone is modified during gestation, tumors of the bone might show increased or decreased activity.

THE EFFECT OF PREGNANCY UPON BONE METABOLISM

The whole subject of normal bone metabolism with its underlying physicochemical processes is not completely known. The deposition of the calcium-phosphate complex is

From the Department of Obstetrics and Gynecology, University of Nebraska College of Medicine.

dependent upon the amount of available calcium and phosphorus in the blood serum, and the presence of an enzyme phosphoric eritase, in the bone (4).

The whole growth of bone, in addition, is under control of the endocrine system as has been demonstrated in the case of the gonads, pituitary, thyroid, and parathyroid glands (Cuthbertson).

Thomson and Collip give an excellent review.

The blood serum calcium level is maintained in part by absorption from the alimentary tract, normal levels demanding a diet balanced in respect to calcium, phosphorus, and vitamin D.

Variations from the normal serum calcium level of 10 milligrams per 100 cubic centimeters of blood are frequent. Hypocalcemia is present in dietary and parathyroid deficiencies. Hypercalcemia is present in hyperparathyroidism.

The secretion of the parathyroid maintains the normal calcification of bone and the calcification of pathological areas in the healing processes (10) by a specific action. It raises the blood calcium level, the excess being obtained from the skeleton.

As to the exact chemical form in which the calcium-phosphate complex is laid down, and in which structure of the bone the storage is accomplished is still disputed. Bauer, Aub, and Albright, and Lambie and his coworkers have brought forth evidence that the trabeculæ of the bones form a mobile store of calcium. Bodansky and Jaffé, however, believe that the bone most recently laid down, in whatever site, is the most readily dissolved.

The calcium storage must surely be mobile in character, reduced on demand, and replenished when circumstances are favorable. Hunter and Aub demonstrated this with their work in lead poisoning.

As a result of the catabolic bone metabolism, calcium is put back into the blood stream, but is it available for bone metabolism? McCrudden, and Bauer, Albright, and Aub believe that calcium once liberated from bones cannot be used again even while bone building is actively occurring. Bauer, Albright, and Aub studied the calcium metabolism during pregnancy and arrived at the conclusion that on a low calcium intake the patient excreted the same amount of calcium as she would have been expected to do had she not been pregnant, suggesting that the calcium excreted is not available for fetal use or for growth during the building of bones. It also suggests that the calcium ingested by the mother is available first to the fetus and that she may use any left over after fetal needs are supplied. The depletion, therefore, of the maternal bones arises not as a withdrawal of calcium for fetal use but from an insufficiency of available calcium to meet the normal requirements of anabolic metabolism.

Thomson and Collip believe that there is a possibility of calcium being transferred from one part of the bone to another. Hamilton has produced evidence to show that the fetus just before birth accumulates a store of calcium which is used in bone growth just after birth.

When pregnancy occurs, metabolism in all its phases is altered and, as a result, bone metabolism is also affected. There is a gradual fall in the serum calcium during pregnancy from the normal of 10.16 milligrams in early pregnancy to 9.4 milligrams in late pregnancy with many readings as low as 8 milligrams (5-8-14-15-17).

The normal hypocalcemia of pregnancy may be due to a variety of causes of which the greatest is no doubt due to the growth demands of the fetus. The calcium demand average is 0.1 gram per day over the entire gestational period (5). To meet this demand some investigators believe that a drain is placed particularly on the mobile store of calcium, depleting the maternal tissues and converting that calcium for fetal use. If the conclusions of McCrudden and of Bauer and Albright and Aub are correct that endogenous calcium is unavailable for fetal use, we must fall back upon the theory that the mobile calcium is depleted but not for fetal use and it cannot be replaced unless there is a surplus of available calcium after fetal needs have been supplied. The maternal anabolic calcium metabolism cannot keep pace with the catabolic process, when the available calcium supply is lowered, as it is in pregnancy, and if during pregnancy dietary factors which lead to hypocalcemia are also operating then the

maternal serum calcium may tend to fall more rapidly. In other instances the hypocalcemia may be due to an altered function of the ductless glands, particularly the parathyroids, for pregnancy makes demands upon the parathyroids often unmasking a latent insufficiency (8).

On the other hand a pre-existing hyperparathyroidism, either latent or active, could be further activated by pregnancy and a hypercalcemia result. Again this calcium is not available for either fetus or mother and is excreted.

In contrast to depletion of bone there is the possibility of the opposite reaction—i.e. increased storage. This may occur as the result of greater calcium intake or changed endocrine stimuli or both. Stander has reported small bony exostoses inside the skull developing during pregnancy.

In summary, then, bone metabolism is altered by pregnancy. Locally the bones are depleted of their calcium-phosphate complex by normal and altered metabolic processes, the fetus using the available supply before the mother's needs can be supplied.

Available calcium supply and hormonal activity may normally affect bone tumor growth. As these factors are altered during pregnancy, in this way will pregnancy indirectly affect bone tumor growth. In addition the local factor of blood supply changes may also play a part. Hyperemia leads invariably to osteoporosis and partial reversion of the bone to a primitive non-specific connective tissue, and ischemia to an increase in calcification and sclerosis (16).

EXOSTOSES AND OSTEOCHONDROMA

These tumors with the groups called osteoma and chondroma form one large group of tumors according to Geschickter and Copeland. The classification has resulted from the incomplete study of the tumors. If only a small section of a tumor is removed for microscopic study and if the whole tumor is not sectioned, the pathological diagnosis will vary as the section contains cartilage, bone, or both. The literature subdivisions will be followed as much as possible for the sake of clarity. A summary of the entire group will then be made.

Malignant changes. These tumors may undergo malignant changes. Geschickter states that in the single lesion the tumor may undergo malignant changes after the patient has reached 30 years of age. In the multiple lesions malignant changes are frequent in the ribs, particularly when associated with lesions of the small bones.

Exostoses. Muller, and Tarnier and Budin both give excellent reviews of the literature. The growths are situated anywhere on the pelvic bones but particularly at the attachment of the tendon. There may be single or multiple pelvic tumors and the size and shape varies.

The tumors grow slowly and in many instances the size of the tumor may be obstetrically insignificant for a number of years. They may become dangerous, first, because of encroachment upon the size of the pelvic canal; second, because of possible perforation of overlying soft parts including the uterus (24); and, third, because of necrosis of soft parts resulting from sustained pressure occasioned during labor (42). The fetus may also be injured as in the case reported by Schrank (38).

As to the effect of pregnancy upon these tumors there is little definite information, but one gains the opinion that pregnancy has little if any effect upon the tumor growth rate. Marchant, Smith, and Schrank mention the slow growth of the tumors in their cases. One author thinks the tumors grow more rapidly (52).

Osteoma. Careful studies of the cases called osteoma would undoubtedly show that these tumors were in reality osteochondroma. The tumors are larger than the exostoses and if not carefully sectioned their true character would be missed.

Cazeau and Tarnier in 1884 recognized only the cases of MacKibbon and Leydig. Ten years later Winckel (50) listed 9 cases. Since then West, Finzi, and Broadbent have each reported a case. The microscopic description of the tumor in West's case is typical of an osteochondroma.

Osteochondroma and chondroma. Schoppig in 1907 made an exhaustive review of the literature concerning pelvic osteochondroma

Fig. 1. Osteochondroma of the left ilium.

and chondroma. He discovered 47 cases which were associated with pregnancy, and reports a case of his own. Muller mentions 7 cases not listed by Schoppig and additional cases have been reported by Deville, Ferroni, and Lederer, bringing the total number to 58. Of the 58 cases 5 were considered as malignant, those of Vaille (46, 47), Bartscher, Jardine, Taufer, and Lederer. These will be considered under a separate title, chondromyxosarcoma.

A review of the original references was undertaken to discover what clinical effect if any the pregnancy had upon the growth rate of the tumor. In the benign groups this was recorded only five times. Some growth rates seemed to be increased (37, 43), some not disturbed (18, 40, 49).

CASE REPORTS

CASE 1. Covenant Hospital No. 30452. The patient, aged 20 years, white female, was admitted on October 15, 1935, complaining of a lump on the left side. Two years previously the patient noticed a small, slowly growing lump near the anterior superior spine of the left ilium (Fig. 1). The mass on admission was the size of a goose egg. She became pregnant in October, 1934, and was delivered by a cesarean section in July, 1935, because of pelvic disproportion. She believes that the tumor did not grow more rapidly during her pregnancy. Other phases of the history are not essential.

Stereoscopic anteroposterior roentgenograms of the pelvis show an irregular, lobular, and rounded tumor mass measuring about 6 by 9 centimeters arising from the crest and posterior aspect of the left ilium and protruding forward over the pelvic brim. The upper femora show thickening and shortening of the femoral necks and the femoral heads are rotated forward and laterally. Small exostoses are present along the medial aspects of the femoral necks, and on the right pubis near the symphysis and on the left pubis in the mid part of the ascending ramus. Small exostoses are also present along the phalanges.

On October 16, 1935, under gas anesthesia the tumor was removed by Dr. P. W. Tipton. She made an uneventful recovery and was dismissed on October 20, 1935. Microscopic sections showed the tumor to be composed of cancellous bone alternating with fibrous tissue. There was no evidence of malignancy.

Diagnosis: Osteochondroma.

CASE 2. Lutheran Hospital No. 2580. Courtesy Dr. L. Hanisch. The patient, a white female, age 28 years, secundipara, trigravida, was admitted to Lutheran Hospital March 2, 1933. The patient's first pregnancy was normal and terminated after a 6 hour labor. The second pregnancy in 1931 was normal but during labor a pelvic examination revealed a firm tumor about the size of a goose egg which was attached to the left half of the sacral area and seemed to be just under the vaginal mucosa. The cervix was almost fully dilated but no descent of the head occurred because it was held up by the tumor described. In view of the fact that the tumor was accessible, an incision of the vaginal mucosa was done and the tumor easily removed. The wound in the vagina was closed, the anesthesia discontinued, and the child was delivered spontaneously. The total duration of labor was 9 hours. The tumor was an osteochondroma.

The last menses preceding the onset of the present pregnancy began June 10, 1932. The gestation continued normally. A pelvic examination revealed a recurrence of the osteochondroma, recurring as numerous small grape sized tumors and encroaching somewhat upon the size of the pelvic canal. The patient was delivered of a normal female child by classical cesarean section. She had an uneventful convalescence, and she and her child were dismissed from the hospital on March 16, 1933. An examination was done 6 weeks later, and the masses were much smaller. At the present time there has been no evidence of recurrence.

TREATMENT

The obstetrical care and type of delivery would, of course, depend upon the location of the tumor and the amount of encroachment upon the pelvic canal by the tumor. Some patients could be delivered through the vagina, others would require cesarean section. A few patients might be delivered by the vaginal route after removal of the tumor through the vagina, as was done in the cases of Drew and Burns, and the case which has been reported above.

Abdominal removal of the tumor might be considered and indicated in some instances during gestation. The enlarged uterus would render a difficult operation more difficult and it would be wise to deliver that patient at term, attempting surgery of the bone tumor at a later date. If cesarean section were done a biopsy should be performed to ascertain a definite diagnosis, particularly if malignancy were suspected.

Extrapelvic osteochondroma. Osteochondroma may occur in bones other than those of the pelvic girdle and complicate pregnancy only by their presence. Review of the literature has not revealed such an instance. A case is reported below.

CASE 3. Methodist Hospital No. 107,799. The patient was a young white female, age 29 years, who entered the hospital May 20, 1934, complaining of a lump on the right shoulder blade. The patient first noticed a small lump the size of a small walnut on the outer lower aspect of her right shoulder blade 7 years ago. She was pregnant at the time. There seemed to be, however, no increase in size or trouble caused by the tumor, until 18 months prior to admission, at which time it began growing rapidly (Fig. 2). There were no intervening pregnancies.

On examination the general physical examination showed a mass about 14 centimeters in diameter fixed to the right scapula. There was no tenderness or impairment of motion.

An excision of the right scapula with the tumor mass was done by Dr. Robert Schrock. Pathological examination showed the tumor to be an osteochondroma. Convalescence was uneventful. A follow up examination done July 17, 1934 revealed an excellent anatomical and functional result.

Inasmuch as the tumor made its original appearance during gestation the problem of the influence of the pregnancy upon its original growth must be considered. Did the pregnancy through its hormones activate an inclusion rest (34) into growth which was only slight, or was it purely a happenstance that the tumor appeared at this particular time? Another question is what caused the tumor to remain quiescent for 5½ years and then suddenly start to grow—was its growth activated by the same condition as that which caused its original appearance? If so, certainly the pregnancy played little or no part in the picture.

Multiple osteochondroma. Two cases of multiple osteochondroma complicated by a pregnancy have been reported. Jacobson reported a case in 1921 and Blackaby in 1931. In the former instance there was a definite family history of this deformity. In a recent personal communication Jacobson (31) stated that the patient was delivered spontaneously by a midwife and that he had since lost track of the patient. In Blackaby's case, which was delivered by hysterotomy at term, there again is no mention of the effect of pregnancy and the puerperium. Those tumors may undergo secondary malignant changes, becoming a chondromyxosarcoma and causing death.

Fig. 2. Osteochondroma of the left scapula.

CASE 4. Mrs. N. W. M., nullipara, primigravida, had her last period November 10, 1933. In February, 1934, she noticed a small hard lump deep under the right breast. It was about the size of a walnut, hard and immobile. In May because the tumor increased in size she entered the University Hospital in Omaha. At that time the patient had lost considerable weight, was suffering from a non-productive cough and pain in the right axilla and arm.

Examination of the patient showed a moderate lymph adenopathy of the cervical glands. Under the right breast and extending upward and toward the axilla was a large mass 18 centimeters in diameter and about 10 centimeters in depth above the chest wall. The mass was large, regular in contour, nontender, unattached to superficial skin or breast tissue,

but firmly attached to the chest wall. Breath sounds were absent over the entire right chest except at the apex.

In the abdomen the uterus was enlarged by a 7 months' pregnancy.

There was a firm, hard enlargement of the proximal end of the humerus and similar lesions were noted on the distal end of the proximal phalanx of the third digit of the right hand and on the distal end of the right femur. (Her father also had multiple exostoses.)

Roentgenographic study of the right hand shows a bony exostosis 8 by 12 millimeters rising from the distal end of the proximal phalanx of the middle finger. The chest shows a density overlying the right fourth to sixth ribs anteriorly in the region of the superficial mass. The origin of this tumor mass is probably from the fourth rib or adjacent tissues and has grown inward into the chest as well as outward into the thoracic wall. The skeleton shows multiple exostosis of a bony consistency, arising from the femoral neck and the humeral neck.

The patient was then dismissed to her physician who treated her with Coley's toxin. Very little change was noted in the local or general condition.

On August 17, 1934, she was delivered of a 7¼ pound baby girl by cesarean section because of marked respiratory and cardiac embarrassment. She made an uneventful recovery from her delivery but her general condition became worse. The thoracic tumor became necrotic and drained through the skin. She died May 22, 1935.

The patient presented a family history of skeletal abnormalities. Her bone lesions gave her no difficulty until during the third month of pregnancy when one of the rib lesions began to grow rapidly. Did pregnancy activate the tumor growth rate? The tumor was situated near the right breast which undergoes changes during pregnancy and it is reasonable to believe that activation did occur as a result of pregnancy.

Unfortunately, microscopic examination was not done so the exact histology could not be ascertained. It could be assumed to be a sarcoma from x-ray examination and case history. Did the malignant growth result from metabolic and hormonal changes brought about as the result of gestation? One case cannot answer the question.

Chondromyxosarcoma. Five cases of chondromyxosarcoma were mentioned in a preceding section. In 3 instances the growth rate of the tumor was mentioned. In Vaille's, Jardine's, and Lederer's cases the tumor grew rapidly. Apparently then, pregnancy seems to accelerate the growth of some tumors. The problem of therapy is difficult. If seen late in pregnancy, delivery followed by deep x-ray therapy should be done. The manner of accouchement ideally would be abdominal hysterotomy at which time biopsy material could be obtained. In the cases discovered early in pregnancy the problem becomes difficult. The tumors apparently grow rapidly under the influence of a pregnancy and should one perform an abortion in an attempt to save the mother when our present therapy is so hopeless? Deep x-ray therapy during pregnancy is not indicated as abortion or damage to the child occurs. In some instances it might be better to consider the future of the child than that of the mother. Every case, certainly, should be considered individually and the wishes of the patient and family given careful consideration.

FRACTURES

It has been previously recorded that injury or trauma was one of the etological factors in the production of tumors of the exostosis group. The tissue injured or traumatized in these cases where there is no evidence of bone fracture is precartilaginous connective tissue. Interesting cases have been reported by Blatner, Winckel (51), and See and Tarnier.

CASE 5. University Hospital No. 51,906. The patient, a married, white female, aged 27 years, primigravida, was admitted to the hospital November 19, 1935, in labor. In 1928, 7 years prior to admission, the patient was in an automobile accident sustaining a fracture of the pelvis and rupture of the bladder. She made an uneventful recovery from the accident. She married in 1931 and this was the first gestation. The last period occurred February 11–14, 1935.

The general examination was essentially negative. The abdomen was enlarged by a full term pregnancy, the presentation and position being diagnosed as left occiput posterior, with head well fixed in the pelvic inlet. The external pelvic measurements were within normal limits. A vaginal examination was done because of the history of pelvic fracture. On the descending ramus of the pubic bone a projection was discovered.

A roentgenogram of the pelvis was made (Fig. 3). An anteroposterior roentgenogram with patient in the semisitting position showed a true conjugate of 10 centimeters, left oblique diameter 9.5 centimeters, and the right oblique of 10 centimeters with the fetus presenting with the occiput to the left.

Labor was prolonged, the duration being 41 hours and 5 minutes, the first stage alone lasting 37 hours. The delivery was spontaneous. There was considerable molding of the head. Convalescence and puerperium were uneventful.

SARCOMA

In addition to the chondrosarcomas previously mentioned, Muller under the titles of "Sarcoma" and "Carcinoma" mentions 9 cases. Daubeuf, Lauwers, Zeller, Lees, Barnes and Barnes, and Hardouin and Brault, each report 1 case and Cragin mentions 2 cases.

Vaille states that these tumors grow rapidly during pregnancy and that some of them become much softer during the puerperium. A study of the cases was made with these statements in mind. In the 17 cases cited from the literature, tumor growth was observed clinically to be rapid in 9 instances (55, 56, 58, 59, 60, 61, 64, 66, 68), but it is difficult to determine or to state with any degree of accuracy that the growth rate was influenced by pregnancy and/or the puerperium. Three patients (57, 63, 69) died as a result of cesarean section and tumor growth rate was not noted in these or the other 5 cases.

The following case, one of fibrosarcoma of the left femur, was observed prior to, and through, a pregnancy.

CASE 6. University Hospital No. 50379. The patient, a white female aged 30 years, was admitted to the University Hospital March 11, 1933. About 18 months prior to admission she noticed a lump in the upper part of the left leg. She then noticed some weakness in the leg but had no pains until about 2 months prior to admission, when she twisted her leg. Following this there was an increase in the size of the lump. There was a loss of 9 pounds in 2 years.

The patient was an emaciated white girl whose general physical examination was essentially negative. Locally, the upper third of the left thigh showed a fusiform enlargement, more marked on the anterior, than on the posterior, surface. The enlargement measured 24 inches in circumference as compared with the 19 inch circumference of the right thigh. The length of the left leg was 32 inches, the right 35 inches.

Roentgenogram (Fig. 4) showed a large tumor mass in the soft tissues of the upper thigh, with some irregularity of contour especially in its medical aspect. There has apparently been an extension of the new-growth into the greater and lesser trochanter of the femur at which point there has been some bone destruction with several spicules of the bone extending into the soft tissues in the region of the lesser trochanter. There appears to be some involvement also along the under surface of the femur with some narrowing of the femoral neck. The bones of the pelvis, head of the femur, and the greater trochanter show marked decalcification.

Fig. 3. Old fracture through the acetabulum and descending ramus of the pubis, on the right with some displacement deformity of the latter associated with calcification of excess cartilage at point of union.

A biopsy was done March 16th, 1933, and the diagnosis was fibrosarcoma with a high degree of malignancy.

Patient was given a course of deep x-ray radiation with 600 r units through four ports of the femur.

She was dismissed on April 1, 1933. She returned to the x-ray department from time to time for x-ray treatments (Fig. 5).

She occasionally had periods of amenorrhea which were not present prior to radiation. She had a normal period beginning September 15, 1934, and then amenorrhea. She was not seen from October, 1934, until April, 1935, when she again presented herself. She complained of recurrence of pain especially upon walking, weakness, growth of the tumor, and enlargement of the abdomen. Pregnancy was suspected and a roentgenogram of the abdomen revealed a fetus (Fig. 6).

She delivered spontaneously on May 10, 1935; the infant was normal and survived. She was readmitted to the hospital on June 6, 1935 complaining of rapid growth of the tumor since her delivery. There was no pain. The tumor mass measured 28 inches in circumference and there was a 20 degree contraction of the knee (Fig. 7).

X-ray examination revealed that the soft tissues of the upper left thigh were increased in density and size and multiple shadows (?) were noted along the femoral shaft and through the soft tissues about and below the new-growth which had destroyed all the section of the upper femoral shaft extending from the trochanteric region to a point 15 centimeters below. There is a sequestered fragment of the femoral shaft 20 by 4 millimeters lying 1.5 centimeters medial to the lesser trochanteric area. The femoral shaft through this region shows multiple areas of bone destruction, which appear to extend down along the cortex giving it a moth eaten appearance. There are no apparent metastases in the lung fields or skeletal structures visualized.

The blood hemoglobin was 40 per cent (Sahli); red blood cells, 2,210,000; white blood cells, 7,500. She was given two blood transfusions of 250 cubic centimeters each. No further roentgenogram was given because of the condition of the overlying skin. Patient was dismissed. She died about 1 year later.

The growth of the tumor as observed by the x-ray, i.e. decalcification of the bone, was increased during pregnancy and puerperium. As judged by clinical symptomatology the patient was definitely worse as a result of the gestation and by actual measurement the tumor had increased in size. Because of the close proximity of this tumor to the pelvic girdle, might not the conclusion be drawn that what happened in this tumor might also happen in similar tumors of the pelvic girdle? How these alterations in growth and decalcification are brought about, whether by pregnancy with its altered hormones, by change in vascular supply, by the physiological changes in calcium metabolism, or by all three factors is, of course, open to discussion.

TREATMENT

In general the obstetrical treatment will depend upon the duration of gestation and the amount of pelvic disproportion. Vaille recommends cesarean in all cases for fear of the trauma sustained during delivery activating the tumor or causing metastatic lesions. Lauwers attempted removal of a fibrosarcoma when the patient was in her eighteenth week of gestation. The tumor was removed; the patient, however, aborted on the third postoperative day. She survived both incidents, but the author concludes "that there will probably be a recurrence of the tumor within a short time."

Hardouin and Brault treated their patient with deep x-ray therapy, trying to protect the child with lead sheets. The child, however, when delivered at the seventh and one-half month of gestation, lived only 4½ hours, the postmortem revealing a profuse sclerosis evidently due to radiotherapy. Two months after delivery the patient's general condition was much worse and it was evident that she would not long survive. This single case certainly emphasizes the fact that radiotherapy is contra-indicated in the treatment of pelvic osseous tumors if the pregnancy is to be continued.

The problem of interruption of the pregnancy with subsequent surgery or radiation therapy should be considered only in early gestation, but each case should be considered on its own merits. With our present inadequate therapy of these tumors are we justified in sacrificing both lives? Lees, in 1895, made the observation that it is fortunate for the fetus that the majority of these tumors are discovered late in pregnancy.

GENERALIZED OSTEITIS FIBROSA CYSTICA AND HYPERPARATHYROIDISM

Generalized osteitis fibrosa cystica or von Recklinghausen's disease is most frequently seen in cases of hyperparathyroidism. It is possible that hyperparathyroidism may exist in the absence of hypercalcemia, for the parathyroids are only one factor in the maintenance of the serum calcium level. The reverse may also be true that hypercalcemia may exist with normal or hypoparathyroidism.

Pregnancy apparently aggravates the condition, the parathyroid activity being increased so that further decalcification occurs. The available calcium is used by the fetus and none or very little can be utilized by the mother. Hyperparathyroidism tends to raise the serum calcium. The pregnancy *per se* tends to lower it. Blood calcium readings might, in some instances, be most confusing. The result, of course, would depend upon which one of the two factors was dominant. In very mild cases, hyperparathyroidism in the sense of increased functional activity as a result of the pregnancy might exist without hypercalcemia, or indeed, in the presence of low values of serum calcium (82).

Five cases have been reported in the literature (71, 73, 74, 76).

One case of osteitis fibrosa cystica without hyperparathyroidism had been observed at the University of Nebraska Hospital.

CASE 7. University Hospital No. 37496. The patient, aged 31 years, white, housewife, was admitted to the University Hospital January 6, 1932, with the following history. Following a leg injury at the age of 3 years she has had recurrent attacks of pain in the left hip. She began to menstruate at the

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 4. Fibrosarcoma of the left femur showing extension of the new-growth into the lesser trochanter, and spicules of bone extending into the soft tissue.

Fig. 5. Fibrosarcoma of femur. Appearance 10 months later after radiation showing calcification in the region of the bony proliferation, medially to and surrounding the lesser trochanter.

Fig. 6. Fibrosarcoma of the femur. Appearance 25 months after first film, patient then being 7 months pregnant. Increased destruction of bone present. The cortex, previously well calcified and sclerotic, now appears irregularly invaded through the medial half of the shaft.

Fig. 7. Fibrosarcoma of the femur. Appearance 1 month postpartum; marked destruction of upper femoral shaft.

age of 13 (1914) and noticed that the discomfort in her hip was always worse at that time. She married in 1920 at the age of 19. She became pregnant in February, 1921, and shortly after began to complain of severe pain increasing in severity as pregnancy progressed. She delivered a full term child in November, 1921, and had a second child just one year later in November, 1922. During the second pregnancy the pain in the hip was more severe than that which occurred during the first pregnancy. Following the second pregnancy the pain became steadily worse, coming on in attacks and each attack lasting about 1 month. During 1923 and 1924 there occurred occasional pains in the left tibia and the patient noticed a gradual bowing of the femur with the convexity outward.

She entered the dispensary of the University August 28, 1924, with the complaint stated. A roentgenogram was taken with the following report: "Multilocular cysts involving almost the entire upper third of the left femur, and the ramus of the ischium and pubis. There is an incomplete fracture of the shaft of the femur at the junction of the upper and middle third."

The patient was admitted to the hospital on September 8, 1924, and before an application of a cast could be done she suffered a spontaneous fracture, with 6 inches of overlapping. The patient made a very slow recovery and it was not until 1929 that the patient felt well and could walk with little or no limp. During that year and 1930 she felt very well and had practically no discomfort.

A regular period occurred April 25–30, 1931, following which there was amenorrhea. Within a few weeks of the last period there was a recurrence of the pain in the hip. The patient was able to do her usual light household duties for the next 3 months. During the fourth month of gestation the patient could not bear weight on the left leg without causing pain in the left hip. This continued for 2 months and then diminished somewhat.

Examination showed a well nourished, well developed female who walked with a decided limp, favoring the left leg. There was some enlargement in the neck of the femur. There was shortening of 1 inch. Motion was slightly limited in all planes.

The remainder of the examination was not remarkable except for the gestational tumor which filled the abdomen. The fetal head was floating above the pelvis brim, the position a left occiput anterior.

The blood serum contained 5.5 milligrams of phosphorus per 100 cubic centimeters and 11 milligrams of calcium per 100 cubic centimeters. Other laboratory examinations were within normal limits.

X-ray study (Figs. 8 and 9) of the left femur and the tibia and fibula showed the normal trabeculations through the upper half of the femoral shaft to have been replaced by an irregular cystic lesion which has expanded the width of the shaft and narrowed the cortex; this extends from the epiphyseal line downward to the middle of the shaft. There appears to have been an old fracture in the subtrochanteric region through the cyst. The cyst is crossed irregularly by aberrant trabeculæ.

A study of the pelvis shows the left pubis and ischium to be involved by a similar lesion giving an expansion of the bone, decalcification of its substance in an irregular manner with thinning of the

cortex and loss of the normal trabeculæ. The left acetabulum protrudes into the pelvic inlet narrowing its diameter by about 15 millimeters from the left acetabulum to the right sacro-iliac synchondrosis. There is also decalcification through the right pubis suggestive of less advanced cystic changes.

A study of the left leg shows a similar lesion extending throughout the shaft of the tibia and a small central cystic area in the middle of the shaft of the fibula (Fig. 9). There is about 5 degrees of medial bowing of the tibia and fibula.

Impression: Osteitis fibrosa cystica; old pathological fracture through the left femur and narrowing of the pelvis in its right oblique diameter by about 15 or 20 millimeters. She was seen in consultation by Dr. Herman Johnson of the orthopedic department, who advised abdominal hysterotomy and sterilization because of the evidence of slow progressive character of the process, apparently increasing with each pregnancy, and the possibility of other fractures occurring during delivery through natural channels.

On January 10, 1932, the patient began to have a few regular low abdominal pains, and a classical cesarean section with salpingotomy was performed, spinal anesthesia being used. The child was of the male sex, cried spontaneously and was normal except for a slight elongation of the middle toe of each foot, a characteristic found in its mother and maternal grandfather. The patient made an uneventful recovery and was dismissed on January 24, 1932.

Re-examination was done on June 18, 1932. The patient felt well but had continued to have recurring attacks of pain in the left hip, short in duration and not severe if her activities were somewhat restrained. She had been instructed to take calcium lactate 0.3 and viosterol daily. She had not followed instructions rigidly but was definitely certain that the pain was always worse if she discontinued her medication.

On May 9, 1934, the blood serum contained 5 milligrams of phosphorus per 100 cubic centimeters and 11 milligrams of calcium.

The reported case because of the blood chemistry is one which is not easily classified. As already mentioned a hyperparathyroidism may exist in the absence of a hypercalcemia, and the diagnosis is confirmed or disproved by the examination of the serum phosphoric eritase which is increased. It is also possible—at least theoretically—that in certain cases there would appear a remission of hyperactivity of the parathyroids and during such a time as the remission was present, the blood findings would be approximately within normal limits. Such a possibility is suggested in Bevere and Sorrentino's case which received only a course of hormone therapy over a period of 30 days and remained well. The case presented might possibly have been in a quiescent stage, the symptoms aggravated somewhat by pregnancy but not accelerated, the parathyroids remaining within the normal limits of activity as judged by the blood chemistry studies.

Pregnancy or the puerperium apparently aggravates the condition as shown in the reported cases. Pregnancy should not be undertaken by women affected with the disease. If the woman does become pregnant all measures should be undertaken to effect a cure, and while being studied or treated precaution should be used to prevent a pathological fracture. Delivery should be accomplished in a manner that is safe to both mother and child.

Therapeutic abortion early in pregnancy might be considered but at present there is insufficient evidence to warrant or support such a procedure.

Two of the reported cases (74, 76) showed their onset following spontaneous interruption of the gestation, hence cessation of pregnancy will not always allay the process.

Future pregnancies in cases that are not cured should be avoided, and in the cured cases probably may be undertaken without undue risks if they are properly spaced as to time interval.

SOLITARY CYSTS

The solitary bone cysts are common in young people, usually under 21 (75) and should be seen occasionally in the pregnant woman. However, such a combination is apparently very rare. The following case report is therefore unique.

CASE 8. The patient, a young white female, aged 23 years, was first seen by Dr. Schrock and Dr. Johnson on May 28, 1933. At that time she said she had noticed a gradual swelling in the lower end of the right ulna since August, 1931. She had a normal period in January, 1933, and then amenorrhea. Since the onset of her pregnancy the swelling has increased more rapidly. Examination revealed a fusiform thickening of the lower right forearm on the ulnar side. The patient is approximately 4 months pregnant. X-ray examination showed a multilocular cystic tumor of the lower 3 inches of the ulna (Fig. 10). She was given a course of deep x-ray therapy with some regression of the size of the tumor. The patient delivered in October, 1933, but due to a contracted pelvis, the child was stillborn. Following delivery there was a further decrease in size of the

Fig. 8. Osteitis fibrosa cystica. Irregular cystic lesions have replaced the upper half of the left femur. Similar lesions are present in the left pubis and ischium. The left acetabulum protrudes into the pelvic canal.

tumor. An examination done on September 16, 1935, showed a completely functional wrist with excellent contour. The x-ray showed the process to be entirely arrested.

The growth rate of this tumor was apparently accelerated by the onset of a pregnancy with its attendant bodily changes in the calcium metabolism and activity of the endocrines, especially that of the parathyroids. Unfortunately, blood calcium studies were not made.

The tumor growth responded to the accepted type of therapy, not requiring an increase in the dosage. Solitary cysts, therefore—at least in this one case—have an increased growth rate during pregnancy, respond to the accepted therapy, and are not an indication for an interruption of a gestation.

CANCER—PRIMARY AND METASTATIC

Cancer of the bone may be either primary or secondary and its occurrence in a pregnancy is most rare. Metastatic lesions of the bone are most common in the female and usually are secondary to breast malignancies. The majority of such cases, however, occur late in the childbearing era, accounting for a large part of the infrequency of the complication.

One case of "primary carcinoma" of the sacrum was reported by Berry, in 1886, and is famous, for it is apparently the only instance.

Fig. 9. Osteitis fibrosa cystica. Fibula and tibia of the same patient.

He does not state whether or not the pregnancy affected the growth of the tumor.

Jarcho mentions an instance of multiple metastatic lesions of the skeleton in a woman of 25 who had had a mastectomy done for carcinoma 18 months prior to admission to the hospital. Large metastatic lesions were demonstrated in the pelvis by pelvic examination and by x-ray. These tumors obstructed the birth canal, and the patient was delivered by cesarean section. Again there is no statement made as to how the progress of the disease was affected by the pregnancy.

Case 9. History through courtesy of Dr. R. Schrock and Dr. H. Johnson. The patient was a white female, aged 35 years, who was first seen on December 27, 1933. She gave the history of a mastectomy performed in 1930 for a carcinoma of the breast. She had been well until September, 1933, when she twisted her right upper leg and hip. There was some pain at the time of the injury, and this had progressed and she walked with a slight limp. Roentgenograms revealed a pathological absorption of the neck of the right femur secondary to carcinoma of the breast. About 600 r units of deep

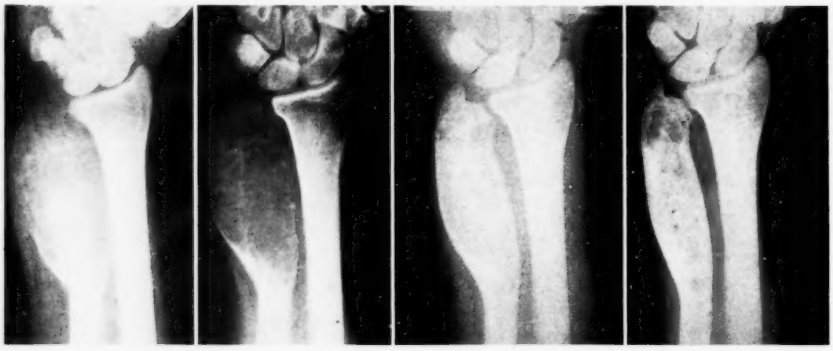


Fig. 10. Solitary bone cyst of distal end of the left ulna showing regression of tumor under treatment during pregnancy and puerperium.

x-ray therapy were delivered anteriorly and posteriorly over the region of the right hip. During the first 8 weeks following the treatment, there was relief of pain. On March 14, 1934, she returned complaining of pain in the hip associated with some difficulty in the use of the right leg and thigh. Fluoroscopic examination showed no gross deposits in the chest. X-ray examination of the hips was done and the coxa vara at the right femoral neck had been increased. A roentgenogram of the lumbosacral spine was made. No abnormality was found, but a fetal skeleton was demonstrated. The patient admitted the possibility of pregnancy and stated that her last period had occurred 5 months previously. The patient then visited another city where a therapeutic abortion was done, the consultant being of the opinion that the pregnancy was definitely affecting the progress of the disease. She was seen again May 23, 1934. The pain in the hip was increased and in addition some swelling was present in the right hip. Over the hip region 900 r units were administered and a sterilization dose of roentgen therapy was administered over the pelvis. The patient continued to fail and died one year later from extensive pulmonary metastases.

Fig. 11. Metastatic carcinoma of the right ilium. Anteroposterior study of the pelvis showing irregular destruction of the right ilium.

CASE 10. University Hospital No. 52476. The patient, white, married female, aged 30 years, was admitted to the University Hospital January 21, 1936. The patient states that on or about September or October, 1934, she noticed a hard nodule in the upper outer quadrant of the right breast. In February, 1935, a radical mastectomy was done. A month after her dismissal she developed a backache in the lumbosacral area, which has persisted. On May 24, 1935, she had a regular normal period and then a total amenorrhea. About the same time she noted a "scabbing" of the lower angle of the wound and in September pus began to drain from this area. Examination revealed a recurrence of the original lesion for which she was given deep x-ray therapy. In spite of treatment the lesion continued to grow, and a few hard masses appeared in the infraclavicular and axillary areas.

The pregnancy developed normally, the only difficulty being a rheumatic feeling in the hips and lower back, loss of appetite, and lassitude. She fell into labor on January 20, 1936, and after a 2 hour labor was delivered spontaneously. She was admitted to the University Hospital for care of herself and her premature infant.

The patient was a moderately well nourished female, 30 years of age. The face was thin and her cheeks were sunken. The neck was negative. The left breast showed no masses or scars. The right breast had been removed and there was an area of superficial ulceration about 10 by 14 centimeters in size. Small round pea sized nodules were scattered along the line of the incision, and the edges of ulcerative areas and larger nodules were in the axillary and infraclavicular areas. Posteriorly in the midscapular line the eighth or ninth rib was enlarged and tender. The lungs were clear, the heart was negative. The blood pressure was 128/70. The

lower edge of the liver was palpable and extended three fingers breadth below the costal margin. The liver felt nodular and pressure over the liver area caused the patient some pain. The spleen and kidneys were not palpable. The fundus of the uterus was slightly below the level of the umbilicus. The extremities were negative, with no deformities, edema, or varicosities. The reflexes were all normal. Laboratory examination was negative. The urine was negative, the blood hemoglobin 80 per cent (Sahli), the red blood cells, 4,270,000 and white blood cells 14,800.

Roentgenograms of the skeleton were done by Dr. H. B. Hunt.

"Anteroposterior radiographic study of the dorsal lumbar spine and pelvis shows irregular destruction of the right ilium above the acetabulum and an area of destruction in the ninth rib posteriorly indicating metastases. No gross destruction or collapse of the vertebral bodies was discerned, the hilar and perihilar markings were accentuated bilaterally, which is also consistent with metastases. Small areas of destruction are suggested in the upper end of the right tibia, and the junction of the upper and middle third of the left humerus consistent with metastases."

The patient was not permitted to lactate. She was dismissed after 17 days of observation, her only treatment being sufficient x-ray therapy to inactivate the ovaries. The child gained well on artificial formula and was dismissed in good condition.

Dawson, Lee, Kilgore, and Trout, all present cases in which the growth of the primary and secondary lesions in carcinoma of the breast was apparently rapid after or during the incident of pregnancy and/or lactation. There are no instances of the occurrence of a pregnancy after the appearance of bone metastases in their series.

Lee advises sterilization by radiotherapy of women treated for mammary carcinoma before the menopause or the interruption *at an early stage* of a subsequent pregnancy.

Geschickter, in discussing skeletal metastases in carcinoma of the mamma, states that the interval between the appearance of the primary tumor and the appearance of the metastases to bone was 32½ months, and that the duration of life thereafter was from 7 to 18 months, depending upon the type of tumor and the radiation. In the first case the time interval was 3 years and the duration of life afterward was 18 months. It is doubtful if the pregnancy in this instance lent any acceleration to the progress of the disease. Certainly the interruption of the pregnancy did not allay the rapidity of the tumor growth, for the patient lived 18 months, the same time (theoretically at least) as she would have lived had she not been pregnant.

A review of the first case raises the question as to the therapeutic value of abortion in this type of case. The prognosis is already extremely poor, and should one sacrifice both individuals in an effort to save one—especially one who already has a hopeless prognosis?

In the second case the evidence of local recurrence and the occurrence of the pregnancy were almost simultaneous. Undoubtedly in this instance the pregnancy did, through its hormones, accelerate the growth rate of the tumor. The inactivation of the ovaries at the time of the mastectomy, or a very early therapeutic abortion might have given the patient a longer life span.

The performing of a therapeutic abortion after the occurrence of bone lesions seems to the author to be contra-indicated except in those cases of scirrhus carcinoma of the breast in which bone lesions occasionally exist for many years, the host comfortable and requiring little or no therapy.

BIBLIOGRAPHY

1. Bauer, W., Aub, J. G., and Albright, F. J. Exper. Med., 1929, 49: 145.
2. Bauer, W., Albright, F., and Aub, J. C. J. Clin. Invest., 1929, 7: 75.
3. Bodansky, A., and Jaffé, H. L. J. Exper. Med., 1931, 53: 591.
4. Bodansky, M. Texas S ate J. Med., 1934, 30: 218.
5. Cantrow, A. Calcium Metabolism and Calcium Therapy. Philadelphia: Lea & Febiger, 1933.
6. Cuthbertson, D. P., and Mackey, W. A. Glasgow M. J., 1935, 123: 249.
7. Emge, L. A. Tr. Am. Gynec. Soc., 1934, 59: 258.
8. Engelbach, W. Endocrine Medicine. Vol. 3, pp. 230–232. Baltimore: C. C. Thomas, 1932.
9. Hamilton, B. Acta Pediat., 1922, 2: 1.
10. Hanson, A. M. J. Am. M. Ass., 1935, 105: 113.
11. Hunter, D., and Aub, J. C. Quart. J. Med., 1926, 20: 123.
12. Lambie, C. G., Kermack, W. O., and Harvey, W. F. Nature, 1929, 123: 348.
13. McCrudden, F. H. Endocrinology, 1922, 4: 734.
14. Merritt, H. H., and Bauer, W. J. Biol. Chem., 1931, 90: 215.
15. Mull, J. W., and Bill, H. H. Am. J. Obst. & Gynec., 1934, 27: 510.
16. Stander, H. J. William's Obstetrics. 7th ed., p. 227. New York: D. Appleton-Century Co., 1936.
17. Thomson, D. L., and Collip, J. B. Physiol. Rev., 1932, 12: 309.

Section on Exostoses and Associated Tumors

18a. Bartscher. Monatschr. f. Geburtsh., 1861, 18: 121.
18b. Behm, E. Monatschr. f. Geburtsh., 1854, 4: 12.
19. Blackaby, E. J. Brit. M. J., 1931, 1: 704.

20. Blatner, J. H. Tr. M. Soc. Albany, 1883, 3: 115.
21. Broadbent, F. Brit. M. J., 1903, 1: 134.
22. Burns, J. Principles of Midwifery. T. C. James, editor. New York: Charles Francis, 1839.
23. Cazeau, P., and Tarnier, S. Obstetrics. 7th Am. ed., p. 579. Philadelphia: P. Blakiston's Son & Co., 1844.
24. Cragin, E. B. Obstetrics. p. 675. Philadelphia: Lea & Febiger, 1916.
25. Deville. Bull. Soc. anat. de Par., 1848, 23: 21.
26. Drew, P. P. Edinburgh M. & S. J., 1805, 1: 23.
27. Ferroni, E. Ginecologia, Firenze, 1905, 2: 4.
28. Finzi, J. M. Lancet, 1894, 2: 77.
29. Geschickter, G. F., and Copeland, M. M. Tumors of bone. Am. J. Cancer, 1931.
30. Jacobson, S. D. Am. J. Obst. & Gynec., 1921, 2: 89.
31. Idem. Personal communication.
32. Jardine, R. J. Obst. & Gynæc., 1902, 2: 99.
33. Lederer, L. Zentralbl. f. Gynaek., 1926, 50: 1106.
34. McMaster, P. E. J. Bone & Joint Surg., 1935, 17 n. s.: 373.
35. Marchant, C. Bull. Soc. roy. d. sc. méd. et nat. de Brux., 1864, 39: 497.
36. Muller, P. Handb. d. Geburtsh., 1889, 2: 373.
37. Schoppig, S. Monatschr. f. Geburtsh. u. Gynaek., 1907, 25: 845.
38. Schrank, J. Med. Chir. Centralbl., 1878, 13: 545.
39. See and Tarnier. Atlas de l'art des accouchements de Lenoir. Paris: V. Masson et Fils, 1864.
40. Shekelton, R. Dublin J. M. Sc., 1850, 10: 287.
41. Smith, A. J. Elec. M. J., 1881, 41: 489.
42. Spiegelberg, O. J. B. Hurry, editor. Trans. from 2d German ed., London, 1887, Vol. 2, p. 128.
43. Stadfeldt. Obst. J. Great Britain and Ireland, 1879, 7: 201.
44. Tarnier, S., and Budin, P. Traité de l'art des accouchements, Vol. 3, pp. 338–352. Paris, 1898.
45. Taufer. Quoted by Schoppig, loc. cit.
46. Vaille, E. Thèse de doct., Paris, 1891.
47. Idem. Internat. Clin., 1918, 2: 143.
48. West, J. N. Tr. Am. Ass. Obst. & Gynec., 1918, 30: 346.
49. Wiltshire, A. Obst. Tr., Lond., 1871, 12: 376.
50. Winckel. Quoted by Wallace, A. J. Lancet, 1894, 1: 1500.
51. Winckel, F. Text Book of Obstetrics. p. 476. Trans. 1st ed. by J. C. Edgar. Philadelphia: Blakiston, 1890.
52. Mich. Univ. M. J., 1890, 1: 337.

Section on Sarcoma

53. Barnes, R., and Barnes, F. System of Obstetrics. Med. & Surg. p. 774. Philadelphia: Lea Bros., 1885.
54. Cragin, E. B. Obstetrics. p. 676. Philadelphia: Lea & Febiger, 1916.
55. Daubeuf. Bull. Soc. anat. de Par., 1850, 25: 257.
56. Elkington. Quoted by Muller, loc. cit.
57. Grimmel. Quoted by Muller, loc. cit.
58. Hardouin, P., and Brault. Bull. Soc. d' Obst. et de Gynéc., 1927, 16: 105.
59. Lauwers, E. Bull. Soc. belge de gynéc. et d'obst., 1899–1900, 10: 250.
60. Lees, J. F. Lancet, 1895, 2: 1288.
61. Martin. Quoted by Tillmanns, loc. cit.
62. Muller, P. Handb. d. Geburtsh., 1889, 2: 373.
63. Retzius. Quoted by Muller, loc. cit.
64. Swaagman. Quoted by Tillmanns, loc. cit.
65. Tillmanns, H. H. Deutsche Chir., 1905, 62a: 754.
66. Toporski. Quoted by Tillmanns and Zeller, loc. cit.
67. Vaille, E. Internat. Clin., 1918, 2: 143.
68. val Meyer. Quoted by Muller, loc. cit.
69. von Haber. Quoted by Muller, loc. cit.
70. Zeller, O. Deutsche Ztschr. f. Chir., 1904, 71: 538.

Section on Generalized Osteitis Fibrosa Cystica and Hyperparathyroidism

71. Albright, F., Bauer, W., Claflin, D., and Cockrill, J. D. J. Clin. Invest., 1932, 11: 411.
72. Barr, D. P., and Bulger, H. A. Am. J. M. Sc., 1930, 179: 449.
73. Bevere, L., and Sorrentino, B. Riforma med., 1932, 48: 313.
74. Churchill, E. D., and Cope, O. Surg., Gynec. & Obst., 1934, 58: 225.
75. Geschickter, C. F., and Copeland, M. M. Tumors of bone. Am. J. Cancer, 1931, p. 243.
76. Schlesinger, H., and Gold, E. Klin. Wchnschr., 1933, 12: 784.

Section on Cancer

77. Berry, S. Obst. Tr. Lond., 1866, 7: 261.
78. Dawson, E. K. Edinburgh M. J., 1935, 42: 633.
79. Geschickter, C. F., and Copeland, M. M. Tumors of bone. Am. J. Cancer, 1931, p. 499.
80. Jarcho, J. The Pelvis in Obstetrics, p. 145. New York: Paul B. Hoeber, 1933.
81. Kilgore, A. R. Arch. Surg., 1929, 18: 2079.
82. Lee, B. J. Am. J. Obst. & Gynec., 1930, 20: 775.
83. Trout, H. H. Am. J. Surg., 1924, 24: 258.

EXPERIMENTAL DUODENAL ULCER

I. F. VOLINI, M.D., H. L. WIDENHORN, M.D., and B. FINLAYSON, M.D., Chicago, Illinois

THERE have been many references within the past few years to the production of experimental gastro-intestinal ulcers by various methods. The original article of Exalto in 1911 gave the first technique for the almost constant formation of these experimental ulcers by the operation known as "surgical duodenal drainage." This operative procedure consists, first, of severing the proximal and distal ends of the duodenum; these ends are then inverted and closed. A small portion, about 1½ to 2 centimeters of the pyloric part of the stomach, is resected. This pylorectomy is done mainly for technical reasons, as the inversion and closure of the gastric and duodenal opening is easier and safer when the rigid muscular layer of the pylorus is removed. The pyloric end of the stomach and the proximal end of the jejunum are closed separately. The lower distal part of the isolated duodenum is then transplanted to the ascending colon by a lateral anastomosis. Then a gastrojejunostomy is performed, in order to restore the gastro-intestinal continuity after the entire duodenal loop with its biliary and pancreatic ducts is isolated. Thus the gastric juice and food are drained into the jejunum while the duodenal secretion with the bile and the pancreatic juice flows directly into the ascending colon.

Mann and Williamson in 1923 varied this technique by inserting the isolated duodenum into the distal ileum. The Exalto and Mann Williamson techniques produce almost 100 per cent of positive ulcers in the jejunum or ileum. Confirmation of these results have been reported by Steinberg, Ivy, Graves, Harper, Dragstedt, McCann, Aron and Weiss, Morton, O'Shaughnessy. The majority of these observers have recorded the finding of acute and subacute ulcers with less frequent observation of the typical chronic gastrojejunal ulcer.

From the Department of Medicine and Surgical Research Department of Loyola University School of Medicine.

It is significant that the majority of observers (Steinberg, Haberer, Berg, Graves, Dragstedt, Mann and Williamson) using the operative techniques described lean to the acid peptic digestion theory of ulcer production citing as the experimental evidence the constancy of ulcer formation after the Exalto operation which means the complete exclusion of the duodenum. The duodenum and its secretions, the major ulcer inhibiting factors, are removed from the normal digestive processes. The alkaline duodenal contents are not present to neutralize the acid peptic digestive factor. Ulcer then results from digestion by the acid gastric juice. Acid is the important factor always stressed. Dragstedt showed the protective action of the duodenal secretion in preventing jejunal and ileal ulcers by varying the Exalto Mann operation in the following manner: he transplanted the duodenal loop closer to the gastrojejunal anastomosis implanting the duodenum into the jejunum only 40 to 50 centimeters distant from the ligament of Treitz. Thus the duodenal secretions are in sufficient proximity to the gastrojejunal anastomosis to neutralize the acid gastric juice. He was able to prevent the ulcer formation in 20 of 21 dogs.

Variation in ulcer formation susceptibility for different portions of the gastro-intestinal tract is well known to investigators. The relative resistance of the duodenum is particularly called attention to by many observers and therefore its removal by surgical duodenal drainage is insisted upon for ulcer production in the ileum or jejunum. The deductions from all these experimental evidences naturally give the acid peptic digestion the foremost rôle in ulcer production. We quote from Dragstedt:

> The work of Exalto and of Mann and his associates provided for the first time a method for the regular production of ulcers in the intestines of dogs, without the use of external corrosive agents. Their finding that the diversion of bile and pancreatic juice to the exterior or into the lower ileum would lead to the development of perforating ulcers in that part of the

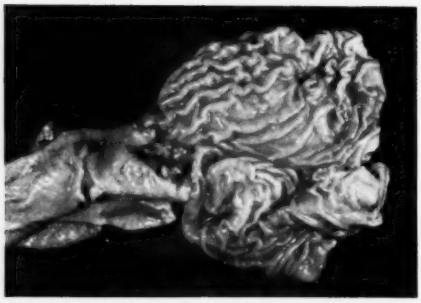


Fig. 1. Dog 6. Specimen obtained at autopsy, after the dog had lived 26 days. Exalto operation. Few small ulcers in the stomach, one large ulcer below the gastro-jejunostomy, with slightly infiltrated edges of the more chronic type of ulcer.

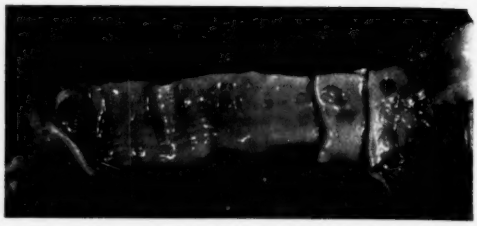


Fig. 3. Dog 1 lived 27 days after Exalto operation. Specimen shows the isolated duodenum with 6 definite ulcers. At the left end are the inverted duodenal stumps.

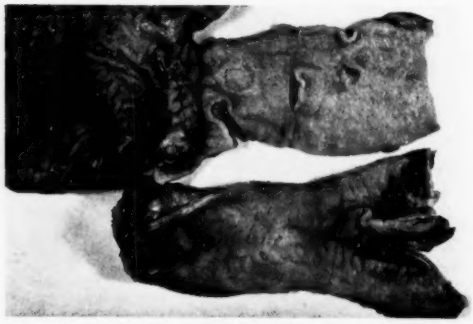


Fig. 4. Dog 25 lived 4 days after Exalto operation. Specimen shows the gastrojejunostomy with an ulcer on the stomach side, one ulcer just below the anastomosis in the jejunum; a part of the ileum is put on to it (to save space), showing also an ileal ulcer. Below there is the isolated duodenal loop showing the inverted proximal stump and 6 duodenal ulcers.

Fig. 2. Dog 13 lived 31 days. Specimen shows two definite jejunal ulcers below the gastrojejunal anastomosis after Exalto operation.

Fig. 5. Dog 27. Photomicrograph of duodenal ulcer. Loss of mucosa and submucosa is shown.

Figs. 6 and 7. Dog 27. Higher magnification. Absence of mucosa with connective tissue infiltration.

small intestine which first receives the gastric content has been amply confirmed. There seems no reason to question the view that it is the neutralizing effect of the alkaline pancreatic juice which normally protects the duodenal mucosa from the acid gastric content.

In a careful study of these various articles we have been unable to find one single reference to the finding of any type of ulcers in the excluded duodenal loop where the Exalto or Mann Williamson technique alone were used.

We now report our observations on 45 experimental animals in which postmortem examination revealed in 28 instances one or more ulcers of the acute, subacute, or chronic type in the transplanted duodenal loop.

The Exalto technique was used in 30 of these animals, the Mann Williamson in 12, and the Dragstedt type of operation in 3. There was no significant variation in the number or character of the duodenal ulcers in the three types of operative procedures. These animals lived from a minimum of 4 to a maximum of 180 days. Some were sacrificed for the postmortem studies while they were still in good condition, while in others the examinations were made shortly after death.

The following description applies to the findings in the isolated duodenal loop ulcers, unless otherwise specifically stated. The ulcers varied in number from 2 to 5. In only 1 instance was only one ulcer found. The ulcerations were principally in two locations: the first site about 2 centimeters from the main pancreatic duct opening; the other on the duodenal side close to the anastomotic opening with the colon or with the ileum. These ulcers were circular or oval in shape, and varied in size from a few millimeters to 1.5 centimeters in diameter. The ulcers were well defined, clear cut, clean in appearance, punched out without undermining, and showed no tendency to perforate, at least within the time limits observed. The tendency to hemorrhage was quite pronounced. In fact, 3 of the animals died from copious hemorrhage from the duodenal ulcerations.

The accompanying photographs of the gross specimen (Figs. 1, 2, 3, 4) illustrate the descriptive features mentioned above.

The microscopic examination reveals the evidence of acute and subacute types of duodenal ulcerations with loss of mucosa, extending occasionally through the submucosa, a surrounding inflammatory zone with a pronounced hyperemia and distention of adjacent blood vessels. Evidence of chronicity was definitely lacking in most of the microscopic sections examined although a tendency to fibrous infiltration was noted, while in a few specimens much connective tissue was evidence of chronic ulceration. The photomicrographs illustrate the microscopic evidence (Figs. 5, 6, 7).

It is to be noted here that most of these animals had, in addition to the duodenal ulcers described, lesions in the jejunum at the anastomosis and just below the anastomosis, and ileum, some of which were of a chronic type. A few animals showed, in addition, gastric ulcerations. These latter findings confirm the earlier observations of the efficacy of the production of experimental gastrointestinal ulcers by the Exalto and Mann Williamson technique.

A control study of the duodenums from 22 apparently normal dogs revealed the presence in 17 animals of circular or elliptical depressions, 2 to 15 millimeters in diameter. These varied in number from 2 to 9. Microscopically these punched out depressions were in every instance covered by intact normal duodenal mucosa; there was no evidence of lymphatic aggregation so that these are not lymph follicles. It is possible that the experimental ulcers described developed at these depressed sites. Bradley, in his recent book *The Topographical Anatomy of the Dog*, makes no mention of such findings in the duodenum. We shall report a larger series with description of the duodenum of the normal dog, with detailed microscopic evidence in order to prevent any confusion that these normal findings are ulcerations.

We find it difficult to explain the reason for the lack of reference in the voluminous literature to the presence of ulcerations in the duodenal loop which we describe as such frequent evidence. No doubt the rather tardy appearance of the upper intestinal ulcers concentrated the attention of investigators,

so that little heed was paid to the examination of the lower bowel and the duodenal transplant. The duodenal ulcers appear soon after the operation and become smaller and less numerous in the longer surviving animals.

Experimentally there are three significant factors in the development of ulcers: first, the mechanical or traumatic factor; second, the susceptibility of the mucosa; and third the chemical factor, free acid plus gastric proteolytic enzymes.

It is difficult to place the etiology of these duodenal ulcers. Is it operative trauma? The same or even greater degree of trauma occurred in the stomach or upper bowel where the ulcer percentage was much lower. The duodenal ulcers appeared in the non-traumatized portion of the duodenum. The vascular supply was not disturbed and no evidence supports this possibility. We furthermore paid particular attention during our operative procedures not to injure the duodenal loop or the pancreas. The food traumatic factor should be evident, but these findings appeared in animals which had not received solid food and the duodenum on examination did not, in any instance, even in the long surviving animals show the presence of undigested food within its lumen.

The acid digestion of the transplanted duodenum could be the cause of the experimental ulcers. However, the experimental animal shows considerable immunity to duodenal ulcers by any technique. Duodenal ulcers are otherwise very difficult to produce except by direct injection of the duodenal wall by various corroding agents. The alkaline duodenal contents are quoted as being the principal protective mechanism.

The absence of free acid rules usually against ulcer development. The ulcers then would develop on a chemical basis due to a removal of or interference with the normal neutralizing effect of the alkaline duodenal secretions on gastric acidity. Von Haberer found 17 per cent of patients developed jejunal ulcer following gastric jejunostomy when pyloric occlusion was present, whereas marginal ulcers occurred in less than 1 per cent when there was no occlusion. Dott and Lim confirmed these findings in experimental animals. Our animals, however, developed ulcers in the duodenum, far removed from gastric acid and gastric contents with the flow of the fluid from the duodenum to the colon rather than vice versa. Charles Mayo claims that 78 per cent of ulcers occur in the duodenum in spite of the alkalinity of the duodenal secretions.

Bile is frequently acid in reaction and not an alkaline secretion. Normally pancreatic juice by reflux through the pylorus probably produces neutralization on the proximal rather than the distal side of the pylorus. These statements presume alkalinity of the duodenal contents. Mann and Bollman report especially in fasting animals, very high acid readings of the duodenal content, usually temporary in duration. We have confirmed these observations in a few of our animals, practically all those examined showing acid duodenal contents even though the duodenal loop is far removed from the stomach by the operative procedure. These latter findings confuse still further the interpretation of the experimental findings demonstrated in our animals. Until the hydrogen-ion concentration determinations were made, acid digestion seemed quite remote as an etiological possibility.

The extensive literature on experimental ulcer reveals many methods of ulcer production, by the use of bacteria (Rosenow, Tuerk, Hardt), and toxic and corroding substances (Ivy, O'Shaughnessy, Payr), by nerve traumatism (Cohnheim), by vascular injuries (Klebs, Rokitansky, Virchow), and by removal of specific glands such as thyroid (Friedman), adrenals (Widenhorn), and pancreas (Elman and Hartman). Operative procedures of the mutilating and unphysiological character, such as the Exalto, Mann Williamson techniques, have been shown to render intestinal ulcers most definitely. Most of the ulcers so produced are of the acute and subacute types and appear soon after the experimental procedure. Our work confirms the fact that the Exalto and the Mann Williamson procedures are, so far as we know today, the best and most dependable methods of producing jejunal ulcers in practically 100 per cent of the experiments. We are not able as yet to explain

satisfactorily the etiology of our findings of duodenal ulcers. This work is to be continued and further research by other co-workers is to be stimulated. The production of experimental duodenal ulcers has not been reported in the literature; our findings we believed, warrant this short report.

SUMMARY

1. Two procedures are discussed by which we have been able to produce experimentally jejunal ulcers: (a) the Exalto method, (b) the Mann Williamson method.

2. Our findings in 45 dog experiments confirm recent reports, that both methods render intestinal ulcers in 100 per cent of the animals.

3. Special attention has been paid to the excluded duodenum, in which we have been able to produce typical acute and subacute and chronic ulcers, varying in size (2 to 15 millimeters) and number. These duodenal ulcers were a frequent finding in 28 of 45 dogs operated upon.

4. Punched out depressions occurring in the duodenum of the normal dog are reported. Grossly these suggest ulcers but the microscopic examination reveals normal intact mucosa.

5. The formation of duodenal ulcers in the experimental animal has not been reported in the literature, as far as it has been available to us.

6. The etiology of these ulcers is discussed without as yet a satisfactory explanation to its possible causes. Trauma should be dismissed as the causative factor.

BIBLIOGRAPHY

1. Bradley, O. Topographical Anatomy of the Normal Dog. New York: Macmillan, 1935.
2. Ivy, A. C. Physiology of the stomach. Studies on gastric ulcer. Int. Med., 1929, 25: 6.
3. Judd, E. Starr, and Waldron, G. W. The present status of the surgical treatment of peptic ulcer. Surg., Gynec. & Obst., 1934, 59: 350.
4. Kapsinow, R. The experimental production of duodenal ulcer by exclusion of bile from the intestine. Ann. Surg., 1926, 83: 614.
5. Mann and Bollman. Reaction of content of gastrointestinal tract. J. Am. M. Ass., 1930, 95: 1722.
6. Idem. Experimentally produced peptic ulcers. J. Am. M. Ass., 1932, 99: 1576.
7. Mann and Williamson. Experimental production of peptic ulcer. Ann. Surg., 1923, 77: 409.
8. Matthews, W. B., and Dragstedt, L. R. The etiology of gastric and duodenal ulcer; experimental studies. Surg., Gynec. & Obst., 1932, 55: 265–286.
9. Mayo, Charles H. Ulcer of the stomach and duodenum. Surg. Clin. N. America, 1925, p. 639.
10. McCann, J. C. Arch. Surg., 1929, 19: 600.
11. Morton, C. B. Ann. Surg., 1932, 87: 401.
12. O'Shaughnessy, L. Etiology of peptic ulcer. Lancet, 1931, 1: 177.
13. Patrick, P. T. Reactions of contents of jejunum and experimental production of peptic ulcer. Arch. Surg., 1935, 30: 557.
14. Volini, I. F., and McLaughlin, R. F. Histidine mono hydrochloride therapy of gastroduodenal ulcer. Med. Rec., 1935, 141: 364–366.
15. Idem. Histidine therapy gastric ulcer. Illinois M. J., 1936, 69: 34–45.
16. Widenhorn, H. L. Experimental studies on the pathology of the adrenals. Arch. f. klin. Chir., 1932, 170: No. 3.

CARCINOMA OF THE PANCREAS

JAMES DAVIDSON RIVES, B.S., M.D., SAMUEL A. ROMANO, B.S., M.D., and
FRED MONROE SANDIFER, Jr., B.A., M.D., New Orleans, Louisiana

PARTICULARLY during the last few years, when an unusually large number of cases have come under our care, we have been impressed with three things about carcinoma of the pancreas. In the first place, it is relatively frequent, considerably more frequent, in fact, than it is generally supposed to be. In the second place, there is an absence of any reliable criteria of diagnosis except in jaundiced cases. In the third place, the surgeons of this community, ourselves included, are employing for it no method of treatment which offers the slightest prospect of cure.

The classic syndrome of painless jaundice, cachexia, and distention of the gall bladder leads to the suspicion of carcinoma of the pancreas, it is true, but that does not cover the situation. For one thing, by no means all cases involving the head of the gland present this syndrome, and none of the cases in which the body and tail are involved are associated with it. Furthermore, laboratory tests of pancreatic function as an index of the disease have so far been without very great value. Even if they should be so developed in the future that they will prove uniformly reliable, they will continue to be without value until we can establish some clinical picture which will direct our attention to the pancreas and suggest their use.

In the light of these facts, it has seemed to us worth while to study a considerable number of histories in detail, with the hope of ferreting out some symptom or combination of symptoms which might be suggestive of the disease, if not pathognomonic of it. After we began our study from this standpoint, it seemed to us profitable to analyze the whole record and to make such contribution to the problem of carcinoma of the pancreas as we were able to derive from that analysis. We might add at this point that we made no attempt to review the complete literature of the subject. We did, however, study the largest series of cases of this disease on record in the literature, notably those reported or collected by Futcher, Eusterman and Wilbur, Kiefer, Friedenwald and Cullen, Leven, Mussey, Ranson, and Speed. These we have used for comparison with our own figures whenever such comparisons were possible and appropriate.

Our investigation, which covers the 10-year period ending December 31, 1935, includes 96 cases selected from the records of Charity Hospital and Touro Infirmary in New Orleans. We use the word "selected" advisedly, for this material represents not more than two-thirds of the histories filed as carcinoma of the pancreas during this period in those two hospitals. We accepted only those cases proved by autopsy or supported by the convincing operative findings of competent surgeons. We rejected several cases in which the autopsy protocols were inadequate or contradictory, and we accepted cases in which autopsy was not done only if the surgeon's notes included a satisfactory description of the gross pathology. We also eliminated all cases of islet carcinoma, in which the picture is definitely different, and all cases suspected of being secondary to growths elsewhere.

After these eliminations there remained 96 cases, in 55 of which operation was done without autopsy, in 16 of which both operation and autopsy were done, and in 25 of which only autopsy was done. We are convinced that all of these cases are *bona fide* cases of primary carcinoma of the pancreas.

FREQUENCY

Any conclusions derived from our statistics as to the frequency of carcinoma of the pancreas would be grossly misleading, chiefly because we are quite sure that many actual cases were entirely overlooked or incorrectly ex-

From the Department of Surgery of the School of Medicine of Louisiana State University, and the records of Charity Hospital and Touro Infirmary in New Orleans.

cluded. Such errors undoubtedly prevail in any small series, and we must turn to larger groups of statistics to get any fair idea of the incidence of the disease. The studies of Hoffman and of Leven indicate an incidence of 1.1 to 2.8 per hundred thousand deaths and an incidence of 1 to 2 per cent of all carcinomas.

AGE, RACE, AND SEX

The patients in our series represented an average age of 58 years, with the range from 25 to 84 years (Table I). The period of greatest frequency was from 50 to 69 years. Sixty-two cases, 65 per cent of the total number, occurred in these two decades, and 88 cases, 92.5 per cent, in the period between 40 and 79 years. These figures are in accord with the large series collected by Leven, which includes the 441 cases collected by Kiefer, and they are also in accord with the expected age incidence of cancer in any organ.

There were 78 males and 18 females, a ratio of 4.3 to 1, the male incidence being higher than most other reports indicate. In a total of 872 personal and collected cases (Kiefer, Friedenwald and Cullen, Mussey, Eusterman, Leven, and our own) there were 606 males and 266 females.

Our figures show 69 white and 27 negro patients, a ratio of 2.5 to 1. Discarding the cases from Touro Infirmary, to which institution negroes are not admitted, the ratio is 3 to 2 (68 cases, 41 white and 27 negro). Since the proportion of white to negro admissions in Charity Hospital has been approximately 55 to 45 for the last 10 years, there is evidently a slight preponderance of the disease in white patients. Other observers report that carcinoma of the pancreas is relatively rare in negroes. Futcher, for instance, in a report of 31 cases from Johns Hopkins Hospital, found the ratio 7 to 1, which is at wide variance with our own figures.

PATHOGENESIS

In view of its frequent association with carcinoma of the pancreas it has been suggested (Hulst, quoted by Ewing) that chronic pancreatitis is the actual cause of the malignancy. We are unable to discuss this theory on the basis of our own studies, for the reason that

TABLE I.—LOCATION ACCORDING TO AGE, RACE, AND SEX

Age in years	Head	Head and body	Body	Tail	Diffuse	Total	Percentage
20–29	2					2	2.
30–39	3	1			1	5	5.
40–49	8	3	1		3	15	16.
50–59	24	4	2	1	2	33	34.4
60–69	17	4	1	6	1	29	30.2
70–79	6	2	1	2		11	11.4
Over 80	1					1	1.
Total	61	14	5	9	7	96	
Percentage	63.5	14.6	5.2	9.4	7.3		
Sex							
Male	47	11	4	9	7	78	81.7
Female	14	3	1			18	18.3
Race							
White	46	10	3	5	5	69	71.9
Negro	16	3	2	4	2	27	28.1

in these records the condition of the uninvolved tissue was not usually described. When such information was available, cirrhosis of the gland and dilatation of the ducts were the chief findings, and they point, rather, to the theory that chronic pancreatitis is simply a normal concomitant, so to speak, of the malignancy and not its true cause. Malignant tumors of the pancreas inevitably obstruct the ducts draining a large portion of the gland, and such an obstruction can reasonably be expected to cause fibrosis and other inflammatory changes, while such changes are likewise inevitable in the tissue adjacent to the neoplasm.

Clinical facts support us in our refusal to accept chronic pancreatitis as the cause of pancreatic malignancy. In the first place, the sex incidence is against it. Chronic pancreatitis is commonly supposed to be the result of biliary disease, which in turn is supposed to be about three times as frequent in females as in males. But this series, as we have pointed out, shows a male incidence roughly four times higher than the female incidence. In the second place, the racial incidence is against it. Gall-bladder disease is distinctly unusual in the negro, and particularly in the negro male (Maes and McFetridge, Bloch), while our own figures show no very

TABLE II.—LOCATION IN COLLECTED CASES

Author	Total number	Head	Body	Tail	Diffuse
Kiefer*	159	95	12	14	38
Kiefer†	33	24	3	2	4
Leven	127	82	5	16	24
Authors' cases	96	75	5	9	7
Total	415	276	25	41	73
Percentage		66	6	10	18

*Collected series.
†Personal series.

marked racial differences in the incidence of pancreatic malignancy.

Finally, if chronic pancreatitis were a frequent forerunner of pancreatic malignancy, we should expect to find in most cases a long standing history of dyspepsia. But such a history was found in only 19 of the 93 cases in which any adequate history was available, and only 9 cases of gall-bladder disease were noted in the entire series (7 with stones and 2 without stones). All the probabilities, therefore, seem to be against chronic pancreatitis as a cause of pancreatic malignancy.

PATHOLOGY

Our data were not sufficiently detailed to permit conclusions as to the histological type of growth (whether duct or gland cell carcinoma), and the sections themselves were not usually available for study. We have therefore attempted no consideration of microscopic pathology

Table II shows the various locations of the malignancy in our series and other reported series, and needs no special comment except to emphasize the fact that in 82 cases, 85 per cent of the total number, the head was involved, with or without other parts of the gland. The fact that no cases are recorded as involving the body and tail together can probably be accounted for by the rather vague line of demarcation between the two parts of the gland. Other series show to a greater or less degree the same tendency for the malignancy to involve the head of the pancreas.

METASTASES

In considering metastases in carcinoma of the pancreas we have eliminated from the discussion all cases in which autopsy was not done, since the operative findings are necessarily incomplete on this point. No metastases were reported in 43 of 71 operative cases, which, in view of the unhappy end-results, seems rather too large a number of localized cases to be accepted without grave misgivings. In the 28 operative cases remaining the liver was by far the most frequent site of the metastasis, with the glands about the head of the pancreas next and direct infiltration of the stomach, duodenum, and mesentery last.

TABLE III.—SITE OF METASTASES AND REGIONAL SPREAD

Metastases	Total	Per cent	Leven
Total cases	41		99
Liver	29	70.7	59.0
Regional nodes	14	34.2	50.0
Peritoneum	8	19.5	11.0
Mesentery and omentum	9	21.9	
Lungs	4	9.7	11.0
Pleura	2	5.0	5.0
Heart and pericardium	1	2.5	
Spleen	2	5.0	11.0
Adrenal glands	3	7.5	13.0
Gall bladder	3	7.5	
Involvement of gastro-intestinal tract	25	61.0	

Table III shows the metastases recorded in 41 cases in our series in which autopsy was done, as compared with the proportion recorded in Leven's excellent study of 99 autopsy cases. One or two facts call for brief comment. Only 4 cases showed no metastases. The high proportion of cases in which the liver was involved (29), almost twice the proportion of regional lymph node involvement, leads to the deduction that hepatic involvement must be blood-borne. If this deduction be correct, hepatic involvement naturally will occur earlier than lymphatic involvement, and the performance of radical surgery seems a forlorn hope. Eusterman reports that only 52 per cent of the cases handled at the Mayo Clinic showed metastases, the order of frequency being the liver, the regional lymph nodes, the peritoneum, the omentum, the pelvic organs, the mesentery, and the stomach. Both Eusterman and

Leven point out that adjacent abdominal viscera are frequently involved by direct infiltration.

The gastro-intestinal tract was involved in 24 of the 41 autopsy cases, the metastases involving the duodenum in 11 cases, the stomach in 9, the transverse colon in 2, and the descending colon and the small bowel in 1 each. In one case there were multiple areas of involvement. The frequency of duodenal involvement when the original malignancy involved the head of the pancreas (11 of 32 cases) is noteworthy. The lesions which invaded the stomach, on the other hand, were located in all parts of the pancreas. Lesions of both stomach and duodenum, as our clinical study will show, are likely to cause obstruction or hemorrhage or both.

OTHER AUTOPSY FINDINGS

The literature reveals a decided difference of opinion as to the state of the liver in carcinoma of the pancreas. In our own series 28 of the 41 autopsy cases, 51 per cent, were reported to show a palpable liver on physical examination but the actual autopsy findings reduce the figure to 21, in 18 of which the enlargement was due to metastases. The clinical and autopsy findings, furthermore, do not correspond. Only 16 of the 28 clinical reports were confirmed at autopsy, whereas in 6 cases enlargement of the liver which had not been reported clinically was noted at autopsy. We feel safe in saying that the same percentage of error probably runs through the whole series of 96 cases, in which a clinical enlargement of the liver was reported in 61, 65 per cent. We shall have more to say on this subject when the matter of the physical examination is discussed.

Ascites was noted in 18 cases which came to autopsy, but was not a usual finding in the operative cases. It was observed in 48 of Leven's autopsy cases, and in 3 of Kiefer's 33 cases. Ascites is a terminal finding and the figures are naturally likely to disagree if autopsy or terminal figures are compared with the figures for operation, which is presumably done in early or relatively early cases. The explanations advanced for the ascites are variously extrahepatic obstruction (4 cases), intrahepatic obstruction (5 cases), peritoneal seeding (4 cases), and cirrhosis of the liver (1 case); in 4 cases there was no obvious explanation.

The infrequency of peritoneal seeding in this disease (4 cases) as compared with its frequency in other intra-abdominal malignant conditions is remarkable. This finding is mentioned in only 1 operative case, which gives a total of only 5 cases in the whole 96, and we may accept the figures as correct, for it is unlikely that so striking a finding very often escaped attention at operation. Obstruction of the portal vein by extrinsic pressure from enlarged lymph nodes is a theoretic explanation of the ascites, but Boyce's experimental work on stage obstruction of the portal vein, after which ascites did not occur, seems to invalidate that argument.

CLINICAL HISTORY AND SYMPTOMATOLOGY

A discussion of the clinical findings in any disease must properly begin with a discussion of what the late Lord Moynihan first termed "inaugural symptoms." We had hoped to be able to find in these carefully analyzed records some syndrome suggestive of the "inaugural symptoms" of carcinoma of the pancreas, but we regretfully report that we did not. Perhaps this is because the usual routine history is not calculated to bring out the exact character of the patient's earliest complaints. Perhaps internes are not as discriminating in the use of words as they might be—though for that matter, neither are the rank and file of the medical profession, regardless of their greater experience. Whatever the reason, there was nothing in this group of records to furnish us with the syndrome we had hoped to find.

There are in the literature several beautiful descriptions of the symptomatology of carcinoma of the pancreas, the only difficulty being that they usually have no application to the case in hand. In addition to these satisfying literary exercises, there is also a group of hard-dying traditions which have been repeatedly shown to be untrue but which persist, nevertheless, in the consciousness of the average physician. It is still rather generally believed, for instance, that carcinoma of the

pancreas frequently causes diabetes, though there is no evidence whatsoever to support this belief. All diseases of the pancreas, again, are by convention associated with girdle pain, though this symptom is almost never noted in carcinoma of the pancreas. Such intestinal disturbances as constipation or diarrhea are usually considered to be present in carcinoma of the pancreas, but if they are, most patients fail to observe them. If frothy or fatty stools are a feature, as many physicians believe, again patients fail to observe them and we must look to the laboratory for proof of their presence. What is more, it must be a better laboratory than the average general hospital boasts, if we are to believe the evidence of our own records and the casual mention of stool changes reported by observers who have really observed their cases carefully.

In short, many descriptions of carcinoma of the pancreas which abound in the literature seem to be based on impressions rather than facts and are not usually supported by a critical study of a representative number of cases. We ourselves feel that reliance on the so called classic picture of the disease can lead only to disaster, and we agree with Eusterman that a combination of symptoms, and a widely various combination at that, is far more in accord with the true facts. Furthermore, if symptoms are not evident enough early enough, or are not definite early enough, for a correct diagnosis to be made, it is almost useless to discuss the matter except for such intellectual satisfaction as the investigator may derive from his effort. Such discussions do not benefit the patient. Delayed diagnosis always means delayed treatment, and delayed treatment in carcinoma of the pancreas seals the patient's doom.

DURATION OF SYMPTOMS BEFORE HOSPITALIZATION

Basing our statistics on the 93 records in which the histories were sufficiently full for analysis, we find an average duration of symptoms before admission of 4.8 months, which agrees closely with Kiefer's estimate of 4.3 months. If we eliminate 5 cases with a history of symptoms for 2 years, the average duration in our series is practically the same for the various locations of the malignancy (5 months for the head, 4.2 months for the body, 3 months for the tail, and 5.6 months for diffuse lesions). Our suspicion concerning these unusually prolonged histories is that the symptoms of some other abdominal disease, such as chronic cholecystitis, merged imperceptibly into the symptoms of carcinoma of the pancreas. The average duration of life after the onset of symptoms is given by Mayo-Robson (quoted by Leven), Heiberg (quoted by Leven), Leven himself, and Friedenwald and Cullen as between 5 and 8 months, which makes it illogical to accept absolutely a 2-year duration of symptoms before treatment. Even if these cases be included, however, there is still no significant difference in the duration of symptoms before treatment for the different locations of the malignancy. The shortest duration was in a case of carcinoma of the head of the gland (1 week), and so also was the longest duration (2 years).

We had thought that since jaundice is a frequent early symptom of carcinoma of the head of the pancreas, patients so affected might apply for treatment earlier than those with less striking symptoms, but the figures do not justify this surmise. There was no correlation, furthermore, between the duration of symptoms and the extent of the growth. One patient with diffuse involvement of the gland and extensive metastases had been ill only 2 weeks. Others with smaller, localized lesions told a much longer story. It was discouraging, too, to note at autopsy how many patients with mild symptoms of short duration had lesions which could not possibly have been extirpated. At that, however, autopsy revealed a small number of cases, some 8 in all, in which all gross evidence of the disease might have been removed by surgery, from which we may conclude that in a certain percentage of cases of pancreatic carcinoma there is at least a theoretic possibility of successful operation.

SYMPTOMATOLOGY

The only syndrome that is widely diagnostic of carcinoma of the pancreas is the classical syndrome of Bard and Pic, which is supported by Courvoisier's law and which includes cachexia, jaundice, and distention of

TABLE IV.—ANALYSIS OF SYMPTOMS IN RELATION TO JAUNDICE

	Wth jaundice					Without jaundice					
	Head	Body	Tail	Diffuse	Sub total	Head	Body	Tail	Diffuse	Sub total	Total
Total	66		1	5	72	9	5	6	1	21	93
Pain	48		1	5	54	7	4	6	1	18	72
Dyspepsia present Qualitative	33			3	36	4	3	1		8	44
Quantitative	9		1	2	12		1	1		2	14
Dyspepsia in past Qualitative	12			2	14		1			1	15
Quantitative	4				4						4
No weight loss	5				5			1		1	6
not stated	24		1	3	28	5	2	1	1	9	37
amount not stated	7				7			1		1	8
under 20 pounds	5			2	7	1				1	8
over 20 pounds	25				25	3	3	3		9	34
Nausea and vomiting	31			3	34	5	3	1	1	10	44
Constipation	22			2	24	6	2	2	1	11	35
Diarrhea	4			1	5	1	1			2	7

the gall bladder associated with a liver of normal size. This syndrome, however, concerns only the head of the pancreas and does not necessarily appear *in toto* in any case in that location. Any impartial study, therefore, must begin without preconceived notions as to special syndromes, or the infrequency of any special symptom or group of symptoms. Our own pictures prove that point very clearly. Most of the patients with carcinoma of the head of the pancreas did not have a palpable gall bladder, only 88 per cent had jaundice, and the liver findings showed a very high percentage of clinical error, an enlarged gall bladder frequently being mistaken for an enlarged liver and so invalidating the clinical picture. The most important symptoms of carcinoma of the pancreas in the series which we studied are jaundice (77.4 per cent), pain (77.4 per cent), dyspepsia (62.4 per cent), loss of weight (53.7 per cent), and nausea and vomiting (47.3).

Constipation and diarrhea, which were noted respectively in a third and a fifth of the cases, are no more frequent here, we suspect, than they are in presumably normal individuals of the same age group. Diarrhea was less common than in chronic biliary disease and probably has no value as a diagnostic sign. Pruritis, which we had expected to be a common complaint in the 72 cases of jaundice, was noted in only 3 cases.

Pain. The general belief that carcinoma of the pancreas, especially when it is associated with jaundice, is a painless condition was not borne out by our figures nor is it borne out by observers elsewhere. Leven notes pain in 100 per cent of his cases, Mussey in 88 per cent, Friedenwald and Cullen in 83 per cent, Futcher in 58 per cent, and Kiefer in 64 per cent.

Pain occurred in 72 of the 93 cases suitable for study, 77.4 per cent (Table IV), and was relatively more frequent without jaundice (18 of 21 cases, 86 per cent) than it was with jaundice (54 of 72 cases, 75 per cent). It was present in 5 of 6 diffuse lesions, in 4 of 5 cases limited to the body, and in all cases (7) limited to the tail of the gland. On the other hand, of the 75 cases involving the head only 55 (73.3 per cent) were associated with pain on admission. This absence of pain in 20 cases of the latter group cannot be entirely due to the fact that jaundice brought the patients to the hospital before pain developed, for 2 of the 9 patients without jaundice in whom the disease was limited to the head of the gland did not complain of pain on admission. We can only conclude that lesions involving this special area cause pain less frequently than do those

TABLE V.—ANALYSIS OF PAIN

Location	Total	Constant dull	Colic-like	Constant later colic-like	Intermittent non-colic-like	Not described
Head	75	27	6	2	6	14
Body	5	2	1		1	1
Tail	7	7				
Diffuse	6	5				
Total	93	41	7	2	7	15
Percentage		44.0	7.5	2.0	7.5	

TABLE VI.—INAUGURAL SYMPTOMS

	Head	Head and body	Body	Tail	Diffuse	Total	Per cent
Number cases	61	14	5	9	7	96	
Pain	34	8	4	7	5	58	60.3
Jaundice	11	5		1	2	19	19.8
Synchronous pain and jaundice	8					8	8.4
Dyspepsia, anorexia, weight loss	4	1	1	1		7	7.3
Abdominal mass	4					4	4.2

involving other parts of the gland. As an initial symptom the pain in itself was seldom severe enough to force the patient to seek medical advice.

While no definite conclusions could be drawn from our study of the radiation and location of the pain, some facts are very suggestive. Of 46 patients with pain in the upper abdomen, 19, 41 per cent, complained of radiation to the side or the back. Many authors state that in carcinoma of the body of the gland the pain characteristically radiates to the back or the scapula, but of our 17 cases involving this area, with or without involvement of other areas, only 6, 35 per cent, showed radiation, which is practically the same as the incidence of radiation in other areas. In 5 cases in the tail associated with pain, radiation is mentioned only once, and in this case, curiously, there was no pain on the left side. Of 3 very extensive lesions only 1 caused radiating pain, while of 34 cases localized in the head of the gland, 12, 35 per cent, were associated with radiating pain; in 1 such case the pain was limited to the back. Obviously, the location of the lesion has little, if anything, to do with the radiation of the pain.

Distention of the gall bladder has been advanced to explain the pain of carcinoma of the pancreas, but we think that the explanation does not hold. The generally dull character of the pain is entirely against that thesis, and the type, we might interpolate at this point, also helps to differentiate carcinoma of the pancreas from such acute upper abdominal conditions as gall-bladder disease.

Of 60 patients in this series with distended gall bladders, 44, 70.9 per cent, complained of pain, while of 31 patients without distended gall bladders, 28, 90.3 per cent, complained of it. To express it differently, while the gall bladder was distended in 61 per cent (44 of 71) of the patients with pain, it was also distended in 76 per cent (16 of 21) of the patients without pain. This seems almost conclusive evidence that in most cases the pain does not originate in the gall bladder. The lower frequency of pain in patients with distended gall bladders (61 per cent against 76 per cent) is probably due to the fact that the disease in most of these cases was limited to the head of the gland, in which area, as we have already shown, pain is by no means as frequent as it is in other locations.

Our own theory is that the pain is probably due to direct infiltration and distention of the pancreas, with blocking of the pancreatic ducts. We do not accept the suggestion of Chauffard and others that it is due to pressure of the malignant mass on the celiac plexus. Severe pain is probably due to infiltration of adjacent viscera or hemorrhage into the gland with pancreatitis, as was observed in 1 case submitted to autopsy. The fact that 5 of the 41 patients submitted to autopsy did not complain of pain is worth comment: 4 of the 5 had no metastases, while in the fifth case only the regional lymph nodes and the liver were involved.

To consider pain as an inaugural symptom (Tables V, VI), some discussion of its association with jaundice is also necessary. Pain was the first symptom in 58 of our cases, 60.3 per cent, and was by far the most general first symptom; jaundice was next, being complained of first in 19 cases, 19.8 per cent.

Eight other patients, 8.4 per cent, developed pain and jaundice simultaneously, and 18 noted the jaundice within a month after the onset of the pain. We feel quite sure that some of this latter group actually developed pain and jaundice at the same time and simply overlooked the jaundice. We feel it fair, therefore, to combine the figures (19 with jaundice first, 8 with pain and jaundice simultaneously, and 18 with jaundice shortly after the development of the pain), and to say that 45 persons had jaundice with or without pain as one of the first symptoms of their illness. We are supported in this apparent juggling with figures by the fact that while 72 patients revealed a jaundice on physical examination after they had been admitted to the hospital, only 52 of them knew that it was present. We frequently note such ignorance of obvious facts in Charity Hospital, where the color of negro patients obscures such physical findings and where frequently a comparatively low level of intelligence and education introduces other difficulties.

With or without jaundice, however, there is no doubt, from our own analysis, that pain is the most common first symptom of carcinoma of the pancreas. Futcher notes that it is usually the earliest and most persistent of the various symptoms, but does not comment on its frequency. Kiefer reports it as first in only 4 (13 per cent) of his 33 cases, and other writers ignore this special point.

Jaundice. This finding, as we have already noted, was present in 72 of our 96 cases, 77 per cent. It was present in 71 of the 82 cases involving the head of the gland, 87 per cent, though only 58 of these patients, 81.7 per cent, had distended gall bladders, which places the 13 others among the exceptions to Courvoisier's law that the gall bladder is distended in malignant disease. It is possible, however, to explain 8 of the 13 cases in which the gall bladder was not distended. In 1 case only the tail of the pancreas was involved and the jaundice was due to inflammatory changes in the gall bladder and bile duct. The 7 other cases involving the head of the pancreas included 2 cases of non-calculous cholecystitis, 4 cases of cholelithiasis, and 1 case of metastasis to the gall bladder. A rather confusing fact, that of a total of 7 cases associated with cholelithiasis 4 showed grossly distended gall bladders, is probably to be explained by the frequent finding of stones in gall bladders which are not grossly diseased and consequently are capable of distention.

Leven reported jaundice in 77 per cent of his 32 cases, Kiefer in 76 per cent of his 33, Futcher in 74 per cent of his 31, Friedenwald and Cullen in 78 per cent of their 37, Mussey in 41 per cent of his 90, and Eusterman in 46 per cent of his 48.

Dyspepsia. Fifty-eight patients, 62 per cent, complained of dyspepsia as part of their symptomatology on admission. The fact that in most cases (44) this was of the qualitative type (Table IV) is to be expected, since either jaundice or pancreatic dysfunction is usually accompanied by this variety. Sixty-seven per cent (48) of the patients with jaundice complained of dyspepsia, in 36 cases of the qualitative type, and 48 per cent (10) of the patients without jaundice complained of it, in 8 cases of the qualitative type. In other words, qualitative dyspepsia predominates in about the same proportion, whether or not biliary obstruction exists. The surprising fact is that all patients with carcinoma of the pancreas do not complain of it.

Loss of weight. In 37 cases in this series the matter of weight loss was not noted and it is probably reasonable to assume that this finding was not marked in any of them. In 56 cases some definite statement was made. In 6 cases it was definitely stated that there was no weight loss. In the 50 other cases loss of weight is specifically reported as a symptom. Futcher reported a marked loss in 29 of 31 cases, Kiefer in 28 of 33, Coller and Winfield in 27 of 30, and Leven in all of his 32 cases.

The loss in pounds is always considerable. In 8 of our cases the amount was not stated, but in 8 cases it was less than 20 pounds and in 34 it was more than that amount. Kiefer reports an average loss of 28 pounds, Futcher of 32, Mussey of 26, Eusterman of 29, and Keeton losses up to 80 pounds.

It had seemed to us that the anorexia and intestinal indigestion associated with jaundice might be a major factor in the loss of weight, but the facts do not bear it out. Thirty-nine

(54 per cent) of the jaundiced patients reported a loss of weight, but 11 (52 per cent) of the patients without jaundice exhibited the same symptom. As the percentage could be scarcely more nearly the same, our hypothesis must be abandoned. Furthermore, only 35 per cent of the jaundiced patients had lost 20 pounds or more, against 42 per cent of the non-jaundiced patients with this weight loss. It might be suspected from the literature that failure of the extrinsic secretion of the pancreas to reach the intestinal tract because of obstruction of the duct of Wirsung might be a major factor in the loss of weight, but since jaundiced patients are the ones most likely to exhibit such an obstruction, our figures are against that hypothesis also.

Nausea and vomiting. The incidence of nausea and vomiting in other reported series ranges from the 32 per cent reported by Futcher to the 89 per cent reported by Friedenwald and Cullen. It was present in 44 of our cases, 47.3 per cent. We had considered that its frequency might be due to biliary obstruction, but the records show that 47 per cent of the patients with jaundice (34 of 72) complained of this symptom against 48 per cent (10 of 21) without jaundice. We must look elsewhere, therefore, for the cause. A reasonable explanation seems to lie in direct involvement of the gastro-intestinal tract or direct involvement of the pancreas itself. Of the 44 patients who complained of this symptom 15 showed either direct involvement of the stomach, duodenum, and jejunum, or partial obstruction of these structures by extrinsic pressure. On the other hand, since 53 per cent (34) of the patients with biliary obstruction had no nausea, and since 66 per cent (29) of those who complained of nausea had no invasion or obstruction of the intestinal tract, neither jaundice nor gastro-intestinal involvement offers a reasonable explanation for this symptom, and the important cause is probably direct involvement of the pancreas itself.

Hemorrhage. In view of the high incidence of jaundice in this series, it seemed reasonable to expect that hemorrhages of various sorts would be quite frequent. Actually, however, only 5 jaundiced patients exhibited bleeding as a symptom; in one of this group the hemorrhage was due to invasion of the gastro-intestinal tract. Only 4 jaundiced patients, furthermore, died of postoperative hemorrhage. Even if we add to these 9 jaundiced patients, 4 non-jaundiced patients whose bleeding was due to invasion of the gastro-intestinal tract, the total figures for hemorrhage are by no means impressive.

The infrequency of hemorrhage in carcinoma of the pancreas in jaundiced patients parallels the finding of Boyce, Veal, and McFetridge in their analysis of the causes of death after biliary surgery in Charity Hospital. They have no explanation to offer for so striking a variation from the usual figures for hemorrhage in jaundiced patients with cholecystic disease, but it seems a curious coincidence that in our own series dealing with jaundice of a different origin very much the same situation should prevail.

PHYSICAL EXAMINATION

With the exception of diseases of the female pelvis, physical examination is usually unreliable in the diagnosis of neoplastic diseases within the abdomen, and carcinoma of the pancreas is no exception. On the other hand, in a considerable number of cases such an examination does give definite evidence of serious upper abdominal disease, as we shall point out shortly, and when analyzed in connection with the clinical history, it should lead to the appropriate laboratory investigations and should turn one's mind to exploratory operation if such tests do not clear up the situation.

Friedenwald and Cullen noted abdominal masses, excluding palpable gall bladders, in 16 of their 37 cases, Kiefer in 9 of 33, and Futcher in 12 of 21. The primary tumor is probably rarely felt, and metastatic masses in the liver and other viscera, together with the dilated gall bladder, make up the tumors usually felt. Table VII shows the classification of the abdominal masses recorded in our own series. They were palpated in 51 of the 96 cases, but operative and autopsy evidence proves that in a large proportion of cases, probably the majority, the supposed tumor

mass was not the malignant tumor but the liver or the enlarged gall bladder.

Twenty-eight of the 41 cases which came to autopsy, 51 per cent, exhibited clinically, as we have already pointed out, a palpable liver, but the autopsy findings reduce the figure to 21 per cent. Furthermore, only 16 of the 28 clinical reports were confirmed at autopsy, whereas in 6 cases enlargement of the liver was noted at autopsy which had not been reported clinically. These errors are so significant that we believe the repetition of these facts is warranted at this point. Coller and Winfield report the liver palpable in two-thirds of their cases, Leven reports it palpable in 81 per cent, and Kiefer, Futcher, and Friedenwald and Cullen report percentages varying from 57 to 80 per cent. None of these authors, however, states in how many cases the clinical finding was confirmed by operation or autopsy.

The errors noted in palpation of the liver seem to have been perpetrated also in the examination of the gall bladder. Only 27 palpable gall bladders were reported in the records, against 60 grossly distended organs found at operation or autopsy. In a few cases the distention was not marked and the gall bladder perhaps really could not be palpated, but this does not hold true in most cases, as is proved by the repeated use of such words as "enormous" and "tremendous."

Physical examinations recorded in other series seem to be considerably more accurate. Leven reports palpable gall bladders in 14 of 20 jaundiced cases, all confirmed by operation or autopsy. Kiefer was able to palpate 15 of 17 distended gall bladders, and Friedenwald and Cullen 23 of 37. Mussey found palpable organs in 31 of 37 jaundiced patients, and Eusterman mentions 50 per cent palpable in his series.

Tenderness was noted in 51 of our cases, 54.8 per cent, but was without very striking characteristics. The location usually corresponded with the location of the pain. Ranson mentions tenderness in "most" of his cases, Friedenwald and Cullen in 70 per cent, and Leven in 66 per cent.

Jaundice has been sufficiently discussed elsewhere to need no repetition, and we have also mentioned ascites as being an infrequent and terminal state. A slow pulse is very generally regarded as characteristic of jaundice, but we did not find a single instance of brachycardia among our 72 jaundiced patients.

TABLE VII.—PHYSICAL FINDINGS

	Head	Head and body	Body	Tail	Diffuse	Total
Total cases	61	14	5	7	6	93
Jaundice	53	11		2	6	72
Enlarged liver	44	7	1	4	5	61
Tumor	31	10	2	6	2	51
Tenderness	33	7	3	3	5	51
Palpable gall bladder	20	6			1	27
Ascites	8	1	2		2	13
Edema	2		1			3

Considering these various findings from the standpoint of diagnosis, it may be said that the patients with palpable tumors and the patients whose first symptoms were loss of weight, anorexia, and dyspepsia, probably were all at the stage where nothing could be done to help them. Their disease was far advanced before they had reason to suspect its existence, and Gordon-Taylor's unique report of an 8-year cure in such a case does not alter the hopelessness of the general picture.

From the standpoint of the physician such patients appear with their diagnosis already made. The patients with pain and jaundice would be suspected of having some serious pathological state in the biliary tract and pancreas, as would the patients who present jaundice as their first symptom. In the hands of a competent practitioner they would be subjected to prompt exploration, on suspicion if no definite diagnosis could be made. A reasonable number of such patients, we may assume, would have localized lesions, perhaps suitable for extirpation by the method of Whipple, Parsons, and Mullins. The patients with the single complaint of pain form a more perplexing group. In such cases the discomfort is seldom very severe and has no special characteristics pointing to its origin, though perhaps more careful questioning might shed a good deal of light on the matter. We have promised ourselves to be considerably more careful in this regard in the future.

LABORATORY STUDIES

The resources of the laboratory were perhaps not as fully utilized in this series as they should have been, which leads to the natural suspicion that the true character of the lesion was frequently not suspected. Pancreatic function tests, in particular, were not used often enough to permit us to draw any conclusions at all concerning their value. Perhaps they were so little employed because the reports in the literature offer so little hope from them.

Stool examinations were fairly frequent, but the results, except for the absence of bile in jaundiced patients, were uniformly negative. The bulky, fermenting, and putrefying stools repeatedly mentioned as characteristic of carcinoma of the pancreas were not found, nor was a high fatty content noted in any case in which such a study was made. Friedenwald and Cullen, Kiefer, and Futcher report such findings as the exception rather than the rule, and we believe that both of these supposed facts are entirely suppositious. We are supported in our belief that stools of a high fatty content are not characteristic of carcinoma of the pancreas by the recent report of Whipple, Parsons, and Mullins, dealing with the ability of the small intestine to take over the digestive function of the pancreas after resection of the gland. We are further supported by the (unpublished) data of F. F. Boyce on the subject of fat digestion after ligation of both pancreatic ducts and large resections of the pancreas. Even with diets far above the average in fat content he could not produce fatty stools.

The urine showed little worthy of comment. Jaundiced patients showed the usual finding of bile, but glycosuria was noted in only 2 patients, both with elevated blood sugars, one of whom had a history strongly suggestive of an antecedent diabetes. Glycosuria is not a typical finding in carcinoma of the pancreas. Pearce and Eusterman found it in only a small number of their cases, less than 10 per cent, Friedenwald and Cullen noted it in only 16 per cent, Kiefer found it in only 43 of 251 collected cases, and Leven found it in only 3 of 32 patients, 2 of the 3 having a previous history of diabetes.

Nine patients, including the 2 patients previously mentioned as having glycosuria, exhibited a blood sugar above 120 milligrams. In only 2 cases, however, was the tail of the gland involved, and it seems fair to say that the relation of the elevated blood sugar to the neoplasm is very questionable. Certainly the obstinate fiction that carcinoma of the pancreas frequently causes diabetes is not supported by our figures, nor has it ever been supported by substantial evidence or informed opinion.

Eighteen of 49 patients examined (36 per cent) exhibited a leucocytosis, and it is worthy of note in this connection that fever was equally common. It is important to remember, therefore, that when the diagnosis lies between inflammatory and neoplastic disease of the pancreas, the presence of neither fever nor leucocytosis can be depended upon to eliminate malignancy.

The icteric index, gastric analysis, and blood studies offered no information pointing to the diagnosis of carcinoma of the pancreas. On the other hand, the information supplied by the x-ray, which was used in 50 cases, was frankly very surprising to us. Because of the differences in the manner of approach to the problem, these 50 cases must be considered in 2 groups.

Forty cases were studied by Dr. Amédée Granger and his associates at Charity Hospital. This group attaches great importance to the evidence of extrinsic pressure on the gastro-intestinal tract, and even more importance to the widening of the duodenal loop. On this basis they made a correct diagnosis in 17 cases, 40 per cent of the total number studied, though naturally we have no way of knowing in how many other cases the diagnosis was made incorrectly, on the basis of the same finding. In spite of this possibility, however, we are decidedly impressed with their frequency of correct diagnosis.

Drs. Henderson and Rodick, who studied 10 cases at Touro Infirmary, concentrate their attention on extrinsic pressure and actual narrowing of the lumen of the stomach and duodenum, without attempting to identify the cause of the deformities noted. On this basis they noted partial obstruction of

the duodenum in 4 cases (3 in the second portion and 1 not stated), and extrinsic pressure in 2 (1 on the duodenal bulb and 1 on the pylorus). Sixty per cent of their cases, therefore, showed definite evidence of organic disease in the region of the body and head of the pancreas.

Turning to the literature, we find Speed reporting only 2 positive x-ray diagnoses in 23 cases, Leven 6 in 24, and Kiefer none in 13 cases. On the other hand, we have in 50 cases in our series positive or definitely suggestive findings in 23, 48 per cent. Certainly no other method of diagnosis seems to offer so much promise, and the percentage of correct diagnoses will probably be materially improved as the method begins to be more widely used.

THERAPY

The results of treatment by the methods employed in this series form a melancholy picture, and the poor results are substantiated by statistics from most other clinics. Twenty-five of our 71 surgical patients died in the hospital and are promptly eliminated from the discussion. Of the 46 remaining, we have been able to secure a follow-up note on only 20, all of whom were dead at the end of 8 months, and 50 per cent of whom were dead within 3 months. Furthermore, while our information is too slight for definite statements, we may say that we were not impressed in any case with any very marked relief of symptoms after surgical treatment.

In view of this picture, only two factors would seem to make it worth while to carry the procedure beyond simple exploration, which, in itself, results in a definite mortality, though it is the only course open in many cases to make the diagnosis at all. The first reason for operation, other than exploration, is that the diagnosis may be erroneous and that biliary obstruction, which dominates the picture, may be due to some benign lesion such as pancreatitis, stricture of the duct, or unrecognized stone in the common duct. The second reason is that the relief of jaundice by anastomosis of the gall bladder to some part of the intestinal tract may produce some transient clinical improvement in the symptoms due to jaundice. On the other hand, judging by our own statistics, jaundice seems to play so small a part in the incidence and severity of the various symptoms that we should expect little benefit from such a procedure.

Radical resection of the pancreas for cancer has not often been attempted, because of the serious technical and anatomical difficulties involved. Whipple and his associates seem to have solved the problem of radical resection of the head of the gland, and although the operation they propose is a very formidable one, it seems fully justified by the inevitably rapid and fatal course of the disease when it is untreated.

The tail of the gland has been removed many times for benign lesions, and the technique is well described by Clute in a discussion of carcinoma of the pancreas. We cannot agree with him, however, that this procedure is adequate for malignant disease. It does not include regional removal of the lymphatics extending from the tail of the pancreas along both the upper and lower borders of the gland and beneath it into the hilum of the spleen, from which point they lead to the gastrocolic omentum and follow the gastroepiploic vessels toward the pylorus. We have seen at autopsy definite metastases along this lymphatic chain. For this reason we insist that any operation for cancer in the tail of the gland must include the following steps: removal of the spleen with its vessels as far as the resection of the pancreas is to extend; removal of the splenic ligaments as close to the stomach as possible; removal of the entire gastrocolic omentum, including the gastroepiploic vessels. By such a procedure the lymphatic trunks which lead from the tail of the pancreas to the spleen are removed, as well as those which follow the gland itself toward the pancreaticoduodenal and aortic lymph nodes.

It remains to mention in conclusion the operation described by Gordon-Taylor and performed by him in a single case, which resulted in a spectacular cure, lasting 8 years when he made his report. Whether it could be duplicated is another question: the author himself notes that it required a combination of extreme daring and unusual good luck. The malignancy in this case involved the body

of the pancreas and the operation consisted of resection of the tail and body, with parts of the walls of the splenic and portal veins.

SUMMARY AND CONCLUSIONS

1. We have reported herewith 96 cases of carcinoma of the pancreas, all of which were verified by operation, autopsy, or both.

2. The disease is four times more frequent in males than in females, and is slightly more frequent in the white than in the negro race. It is also most frequent between 50 and 69 years of age.

3. The pathogenesis is obscure, but the findings do not support the theory of chronic pancreatitis.

4. More than three-quarters of the lesions occurred in the head, followed in order of frequency by the tail, the entire gland, and the body. Metastases occurred most often in the liver.

5. The average duration of symptoms before admission was 4.8 months, with no significant differences apparent in lesions of various parts of the gland.

6. The most frequent inaugural symptoms were pain and jaundice, pain being by far the more frequent, with dyspepsia, loss of weight, and nausea and vomiting next in order of frequency.

7. Both spontaneous and postoperative bleeding were surprisingly infrequent, in view of the high percentage of jaundiced patients.

8. Palpable masses were reported in more than half of the cases, but usually proved to be the enlarged liver or the distended gall bladder.

9. Of all the laboratory tests employed, only the x-ray gave any significant information. It is important to remember that a leucocytosis does not eliminate the diagnosis of malignancy, nor does the fever frequently associated with it.

10. No radical operations were done in this series, and of the palliative procedures undertaken, none seemed to prolong life or to increase comfort appreciably, even in jaundiced patients.

11. A radical operation suitable for use in malignancy of the tail of the gland is proposed and outlined.

12. From our study we are impressed with the following facts, not all of which have been previously emphasized:

a. Jaundice, when present, is a valuable diagnostic aid, particularly if the traditional dicta be deliberately forgotten that in carcinoma of the pancreas it occurs without pain and without enlargement of the liver. There is, however, no typical symptomatology.

b. Jaundice seems to play no significant part in the clinical course or the symptomatology of the disease other than to cause a slight increase in the incidence of dyspepsia.

c. Pain, nausea and vomiting, and loss of weight in our opinion are most logically explained by direct involvement of the pancreas or by associated metastatic lesions.

d. The x-ray furnishes the highest percentage of correct and tentative diagnoses of any method employed, and should be used routinely.

e. The need for more accurate history-taking, particularly with reference to the earliest symptoms, is obvious.

BIBLIOGRAPHY

1. Bard, L., and Pic, A. Contribution à l'étude clinique et anatomo-pathologique du cancer primitif du pancréas. Rev. de méd., 1888, 8: 257–282.
2. Bloch, E. Cholelithiasis in the negro. Surg., Gynec. & Obst., 1926, 43: 465–475.
3. Boyce, F. F. Unpublished data on fat metabolism after partial pancreatectomy and ligation of the pancreatic ducts.
4. Boyce, F. F., Lampert, R., and McFetridge, E. M. Occlusion of the portal vein. An experimental study with its clinical application. J. Lab. & Clin. Med., 1935, 20: 935–943.
5. Boyce, F. F., Veal, J. R., and McFetridge, E. M. An analysis of the mortality of gallbladder surgery, with a special note on the so called liver death; based on 404 consecutive surgical cases and 100 consecutive surgical deaths in the New Orleans Charity Hospital. Surg., Gynec. & Obst., 1936, 63: 43–53.
6. Chauffard, A. Le cancer du corps du pancréas. Bull. Acad. de méd., 1908, 60: 242–255.
7. Clute, H. M. The problem of cancer of the pancreas. J. Am. M. Ass., 1936, 107: 91–97.
8. Coller, F. A., and Winfield, J. M. Evaluation of palliative operation for cancer of the pancreas. Am. J. Surg., 1934, 25: 64–69.
9. Eusterman, G. B. Carcinoma of the pancreas; a clinical study of 138 cases. Coll. Papers Mayo Clin. 1922, 14: 206–215.
10. Eustermann, G. B., and Wilbur, D. L. Primary malignant neoplasms of the pancreas. South. M. J., 1933, 26: 875–882.
11. Ewing, J. Neoplastic Diseases. 2d ed. Philadelphia and London: W. B. Saunders Co., 1922.
12. Friedenwald, J., and Cullen, T. S. Carcinoma of pancreas. Am. J. M. Sc., 1928, 176: 31–41.

13. FUTCHER, T. B. Cancer of pancreas. Tr. Ass. Am. Phys., 1919, 34: 284–290.
14. GORDON-TAYLOR, G. Radical surgery for cancer of pancreas. Ann. Surg., 1934, 100: 206–214.
15. HOFFMAN, F. L. Cancer of the pancreas. New England J. Med., 1934, 211: 165–169.
16. KIEFER, E. D. Carcinoma of pancreas. Arch. Int. Med., 1927, 40: 1–29.
17. LEVEN, N. L. Primary carcinoma of the pancreas. Am. J. Cancer, 1933, 18: 852–874.
18. MAES, U., and MCFETRIDGE, E. M. Racial trends of the negro and white in certain surgical diseases. Am. J. Surg., 1936, 33 (n.s.): 5–17.
19. MUSSEY, R. D. Pancreatic carcinoma. Med. Clin. N. America, 1919, 3: 681–688.
20. PEARCE, R. M. Cancer of the pancreas and glycosuria. Am. J. M. Sc., 1904, 128: 478.
21. RANSON, HENRY K. Carcinoma of the body and the tail of the pancreas. Arch. Surg., 1935, 30: 584–606.
22. SPEED, K. Carcinoma of the pancreas. Am. J. M. Sc., 1920, 160: 1–10.
23. WHIPPLE, ALLEN O., PARSONS, WILLIAM BARCLAY, and MULLINS, CLINTON R. Treatment of carcinoma of ampulla of Vater. Ann. Surg., 1935, 102: 763–779.

PACKING GAUZE DRAINAGE AFTER PNEUMONECTOMY

Dr. JOSÉ ARCE, Buenos Aires, Argentina

DURING recent years, my experience in lung surgery has increased considerably. Some time ago opening the pleura was a rather exceptional procedure, and approach to the lung was only a step in the process of the eradication of hydatid cysts. Now, however, we often have the opportunity of exploring the lung in cases of bronchiectasis, cancer, and foreign bodies. If hydatid cysts are eliminated we find that cancer is the next most frequent condition that calls for surgical treatment. More than a dozen times I have had to deal with this serious condition. In some of the cases I have simply explored the region without further attempt at removal, because the cancerous lesion was so extensive that it was inoperable. In other cases I have performed a total pneumonectomy, but without success, as my patients died within 24 hours to 8 days after operation. Both my assistants, Drs. Ivanissevich and Ferrari, have performed total pneumonectomy for cancer, but they too have had untoward results. Such failures may be explained by the facts that the patients were in very bad condition as a result of the advanced stage of the disease, that they came for treatment late, that the operation itself may cause respiratory and circulatory distress, and also it should be kept in mind that infection easily establishes itself in the pleural cavity.

Fortunately, our results have improved during the past year. I have had the opportunity of saving the lives of two patients: one, a boy of 12, and the other, a woman of 29 years, were subjected to total pneumonectomy of the right and the left lung, respectively.

In these operations, I did not follow the general technical procedure, and I shall attempt here to present a brief description of my method.

In the first case pneumonectomy was performed for the treatment of congenital bronchiectasis with several cavities present in the right upper and middle pulmonary lobes. When first admitted to the hospital, the boy had an abscess of the upper right lobe, as a result of the infection arising from one of these cavities. One of my assistants, Dr. Ivanissevich, in charge of my service at that time, opened and drained the abscess, and in 2 months, the wound was healed. X-ray examination, however, revealed that the cavities still persisted, and that there was free communication with the bronchi—possibly a recurrence of the infection with all its sequelæ. It was quite logical to consider, without further intervention, that some other disease, such as tuberculosis or amyloid degeneration, might be developing. I therefore advised performing a pneumonectomy at once. The operation was difficult only when I severed the adhesions present between the upper lobe and the chest wall; in the field of the former operation, I noticed that it was bleeding severely here, and it was impossible to control the hemorrhage except by packing.

I decided to pack the entire cavity with gauze to make sure that the ligature that I tied in the pedicle would not slip as sometimes happens and to prevent the formation of a fistula that sometimes is seen in such cases. The packing fitted the thoracic cavity tightly and I covered the stump left at the pedicle with iodoform gauze.

By means of 6 big compresses I was able to control the hemorrhage. Another large compress placed between the others over the lung stump, compressed the mediastinum.

The after-result was excellent; 2 days after operation, the boy was normal, and 15 days later, I removed the 7 compresses used for packing. I was amazed to discover a funnel-like cavity, clean, uniform, even covered with very healthy looking granulation tissue. The costodiaphragmatic sinus, filled with the granulating tissue, had already disappeared, so that the stump was entirely covered and it was impossible to see the silk ligature which

From the Department of Surgery, University of Buenos Aires Medical School.

I had left in the pedicle. The wound was in excellent condition and healed quickly and completely.

A complete report of this case with illustrations will soon be published in another journal. The success obtained encouraged me again to use the "packing drainage" in other cases.

Last September, I operated upon a woman who had a metastatic carcinoma of the lung after the removal 6 months previously of a nevus carcinoma of the face. The operation was performed without difficulty and after the extirpation of the left lung, in the upper lobe of which near the hilus the tumor was located, I inserted into the empty left thoracic cavity a packing similar to that described, consisting of 6 compresses. I left free only the pedicle over which I placed very tightly a large compress of iodoform gauze. Each of the compresses measured about 1 square meter in surface.

The postoperative course was uneventful; the day after operation the patient appeared like one who had had an appendicectomy; convalescence was without incident. Fifteen days after operation, the compresses were removed, and the operative wound was found to be in good condition. In the anterior part of the cavity, the beating of the heart was apparent through the pericardium and the layer of granulating tissue that covered it. Three weeks after operation the wound was greatly reduced in size, and the patient, who had been getting out of bed, was feeling fine.

Can we say that the packing was helpful in bringing about recovery in these 2 cases after total pneumonectomy? I believe that it did have considerable influence in bringing about the favorable outcome and the good condition of the patient immediately after operation. The open wound, well packed, held in check any pleural infection, and there was no further possible reabsorption of toxic material. These two advantages insure a good chance of recovery.

How can we explain the influence the packing drainage had upon the favorable results?

1. The packing drainage filled the hemithoracic cavity, just as a Mikulicz's drain fills the pelvis, thus preventing the retention of liquids that may become more or less septic and cause pleural infection. Gauze packing is much better than rubber tube drainage.

2. Packing drainage in itself acts as a support to the mediastinal organs, thus preventing displacement and insuring good function of the remaining lung. Normally, there is a balance between the two halves of the thorax, because both are filled. If we take out one of the lungs, however, and we leave the thoracic cavity empty, we create a sudden pneumothorax, just as is present in case of injury or the surgical opening of the thorax. The mediastinum is then displaced all the way to the opposite side during the inspiration and toward the diseased side during expiration. This displacement interferes with inspiration as well as with expiration. This does not happen with closed pneumothorax because the positive pressure produced by the air injection into the pleura prevents the displacement of the mediastinum as in the case of an artificial pneumothorax and also of the preliminary pneumothorax that I was the first to introduce into the practice of thoracic surgery.

After pneumonectomy if the thoracic cavity is left empty, the physiological and pathological conditions of open pneumothorax are quickly established, but if the cavity is filled tightly with a gauze packing, we prevent displacement of the mediastinum and the remaining lung will have normal support for its function. The heart will work much better and the equilibrium of function will be soon established.

3. After pneumonectomy, healing begins in the stump, and the healing tends to obliterate the blood vessels and the severed bronchi. The pulmonary artery and veins are ligated very close to the heart, and it may be possible that the clots that develop back of the ligature may advance toward the cavities of the heart and produce some very dangerous form of thrombosis. Perhaps by keeping the organs in place, the packing drainage helps to prevent any possible displacement of the clot and favors the quick complete obliteration of the ligated vessels.

The success that I have had in these 2 cases of pneumonectomy may have led me to explain the results on a mere hypothetical basis, and there may be some other more

accurate explanation of the facts. I believe, however, that at least the first two items in my conclusions are borne out by the facts.

No matter what the explanation may be, the results speak for themselves and are more important than theories. If my colleagues accept my theories, I will have still further reason to continue the use of packing drainage after pneumonectomy in order to help patients after the removal of a diseased lung.

FURTHER STUDY OF BLOOD IODINE CHANGES IN AFFECTIONS OF THE GALL BLADDER

JOSEPH L. DECOURCY, M.D., F.A.C.S., Cincinnati, Ohio

THE importance of being able to estimate the amount of iodine in the blood, both in normal and pathological conditions, is now well recognized. For the past 15 years efforts have been made to establish standards of technique whereby such estimations could be made quickly, easily, and accurately.

Progress has been made, but much still remains to be accomplished. We are now able, however, to make these estimations with sufficient exactness to be of great value in clinical practice. Used at first only in thyroid diseases, the test for blood iodine has shown its usefulness in the diagnosis of numerous other conditions (Perkin, Lahey, and Cattell).

At the writer's clinic the test was made originally upon goiter patients only. More recently its application has been extended so as to become a part of the routine general examination. Our attention to this wider usefulness of the test was attracted when we set out to arrive at a normal standard of blood iodine for the geographical region within one hundred miles of Cincinnati. In this endeavor we made some two hundred determinations upon residents in this area coming under our care. These were patients suffering from a wide variety of affections, many in no way connected with thyroid derangement. Among them were some cases of acute cholecystitis, and also of chronic cholecystitis and liver deficiency.

In a previous report (3) of blood iodine studies in cholecystic disease, I concluded that such determinations might be a better test of liver function in cholecystitis of long standing than the dye tests in general use, especially since iodine is a normal constituent of blood. With the knowledge afforded by such a test, many cases of "liver death" could be avoided by administering glucose before operation to gall-bladder patients showing high blood iodine values.

The present communication is an amplification of these earlier studies. It was noted that a high iodine content of the blood was invariable in the acute cholecystitis cases, much above the 3 to 6 gamma per 100 cubic centimeters which our researches and tests had shown to be normal for our section of the country. In chronic cholecystitis with stones, an average of 20 cases proved to be 16.6; in the chronic condition, with stone in the common duct, it was 2090. Four cases of hydrops of the gall bladder gave an average of 13.6; while carcinoma of the liver showed 650 for 3 cases. These results pointed strongly to the liver as a potent factor in the regulation of blood iodine.

Further researches, together with a large number of clinical observations, served to confirm this opinion. In obstructive jaundice the blood iodine was regularly very high. In cholecystitis and hepatitis also the figures rose far above normal. But the blood iodine remained normal in cases of advanced cirrhosis of the liver, a finding which we were at a loss to correlate with any of the other data which we obtained. The relationship between the liver and the thyroid gland—source of the body's iodine supply—is being widely investigated. (Repetto, Doetsch.)

From the Department of Surgery, DeCourcy Clinic.

These observations are of especial importance in connection with the factors of safety in preparing for operation upon the biliary system. In the past few years we have heard a great deal about "liver deaths." Indeed, a considerable literature upon this subject has been collected.

In reviewing this literature recently (1935) Boyce and McFetridge remark that they were particularly impressed with the occurrence of the hepatorenal syndrome in cases of disease of the thyroid. They cite Weller who, in 44 autopsies upon hyperthyroid cases, found marked hepatitis in 22 and moderate hepatitis in 16, the liver being normal in but 6 subjects. But in a series of control cases, these being subjects who had died from causes other than those involving the thyroid, Weller noted precisely opposite conditions: In 30 cases there was no liver abnormality; in 13, slight hepatic involvement; and there was but a single case in which the liver was extensively involved.

Rowe found the incidence of hepatic complication to be far more frequent with thyroid disease than with any other endocrinopathy. "The objective measures of vital function level such as the blood and urine pictures, respiratory metabolism, and the like," he said, "all exhibit the twofold influence operating in the individual case."

This investigator believes that the thyroid produces aberrations of the respiratory metabolism, while the liver affects the carbohydrate utilization. He sums up his position by saying: "The possibility of hepatic dysfunction with its influence on certain vital function levels in patients with a normal gastro-intestinal history should be borne in mind. Further, liver disorders may complicate other disease states and functional derangements and thus produce both symptoms and objective measurements not suggestive of the primary condition. A frequent association, for whatever cause, between thyroid failure and hepatic dysfunction would seem to be established."

EXPERIMENTAL DATA

Because of the interest aroused by our own observations and the reports, both laboratory

TABLE I.—UNOPERATED UPON CONTROL—RABBIT 1

Day	Food iodine (gammas)	Fecal iodine (gammas)	Urinary iodine (gammas)	Blood iodine (gammas per 100 c.cm.)
1	11.4			
2	0			4.4
3	3.7			
4	13.6		3.8	
5	6.8	6.3		
6	6.8		3.4	
7	7.4			
8*	7.4			
9	7.4			
10	6.2			
11	6.9			
12*	7.4			
13	3.4			
14*	6.4		40	
15	9.1			
16	6.0			
17	9.1			
18	10.8			
19*	12.5		11	
20	221			
21	226			
22	222			16.5
23*	15.6			14.5
24	17.9			17.5
25	14.6			
26	15.4			
27*				8.5
28				
29				
30				7.2

*BLOOD COUNT

8th Day
RBC.....4,590,000
WBC.....8,450

12th Day
RBC.....4,910,000
WBC.....7,750
Polys.....13%
Lymphos.....79%
L. monos.....4%
Baso.....2%
Turck's.....1%
Eosin.....1%
Stabs.....1%

14th Day
RBC.....5,190,000
WBC.....7,200
Polys.....8%
Lymphos.....89%
L. monos.....2%
Baso.....1%
Stabs.....1%
Shift.....12%

19th Day
RBC.....5,710,000
WBC.....6,250
Polys.....8%
Lymphos.....87%
L. monos.....2%
Baso.....3%
Stabs.....1%
Shift.....12%

23rd Day
RBC.....5,040,000
WBC.....7,050
Polys.....3%
Lymphos.....93%
L. monos.....1%
Eosin.....1%

27th Day
RBC.....5,110,000
WBC.....7,000
Polys.....12%
Lymphos.....84%
L. monos.....3%
Baso.....1%
Stabs.....1%
Shift.....9%

TABLE II.—COMMON DUCT LIGATION—RABBIT 2

Day	Food iodine (gammas)	Fecal iodine (gammas)	Urinary iodine (gammas)	Blood iodine (gammas per 100 c.cm.)
1*	12.6			
2	0		No urine	3.9
3	0		Lost	
4†	1.7	No feces	5.0	
5	6.8		Lost	
6	0		5.4	
7‡	0	11.6	5.9	31.4

*No blood counts were taken.
†Operated upon.
‡Died 9:30 a.m.

and clinical, which seem to give added confirmation to what we had ourselves witnessed, we decided to undertake some animal experiments with the hope of adducing additional data on a subject which remains persistently obscure. Three rabbits were employed, one being retained as a control, while the other two were subjected to operation. Tables are appended which show the facts sought and the data which were secured.

The iodine content of the daily intake of food is expressed in gammas for each successive day. It will be noted that the iodine elimination in urine and feces is likewise recorded for each day. It should be mentioned, however, that inability to prevent contamination of the urine makes these data more or less untrustworthy. Allowance must be made for this fact. The iodine content of the urine has been demonstrated to vary with the kind of food ingested, the time of day, state of the weather, age of the subject, etc., while the iodine content of the blood remains relatively unaffected by such external conditions (Curtis).

In Table I for control rabbit, Rabbit 1, it will be noted that the blood iodine never went above 17.5 gamma, even when the iodine constituents of the food raised the intake to 226 gamma and maintained it at that level for three successive days. These figures were obtained on the basis of a normal iodine content of the blood being 4.4 gamma.

Rabbit 2 was subjected to common duct ligation, after having been under preliminary observation for a time sufficient to establish its normality at the outset of the experiment. Silk suture material was employed in the ligation. Estimation of the blood iodine on the third day following common duct ligation showed it to have risen to 31.4 gamma. The blood counts on succeeding days, as well as the date of the appearance of jaundice, are noted.

Rabbit 3 was likewise subjected to common duct ligation and, in addition, on the third day thereafter, to division of the duct. The animal remained under close observation for 27 days thereafter. During this time the food of this rabbit and of control Rabbit 1 was precisely the same, yet in Rabbit 3 the blood iodine rose to a high point of 227 gamma and was 224 on the same day that of Rabbit 1 was but 14.5. Just before death, on the twenty-sixth postoperative day, the blood iodine fell to 62 gamma.

These experiments, together with clinical observations made during more than 2 years, have convinced us that the liver plays a very important part in the maintenance of a normal blood iodine, irrespective of the kind or amount of food ingested.

EVALUATION OF STUDY

In considering these findings, the question naturally arises: What part of the liver is concerned in the retention of iodine in the blood? This question still awaits an answer; but it is our impression that the Kupffer cells, which are the hepatic representatives of the reticulo-endothelial system, play a leading rôle in this mechanism.

In the parenchyma of the liver there are two chief types of cell: i.e., the hepatic cells and less numerous and important the stellate cells of Kupffer. "These cells," to quote Mann, "are ordinarily now considered as not pertaining ontogenetically to the hepatic organization, but rather to the system of macrophages which abound elsewhere in the body . . . . Kupffer cells were originally considered a part of the endothelium of the hepatic lobule and were often designated as specialized endothelial cells . . . . [but] . . . . it is far more likely that definitely organized endothelium does not exist within the hepatic lobule, but that a syncytial membrane, to-

TABLE III.—COMMON DUCT LIGATION FOLLOWED BY DIVISION OF DUCT—RABBIT 3

Day	Food iodine (gammas)	Fecal iodine (gammas)	Urinary iodine (gammas)	Blood iodine (gammas per 100 c.cm.)
1	10.7			
2	3.4		No urine	4.4
3*	0		No urine	
4	2.6	no feces	Lost	
5	6.8	no feces	No urine	
6	2.6		216	
7	4.9	7.5	4.5	
8¶	3.8		No urine	
9	3.4		389	
10	5.5			
11	5.6		No urine	
12¶	4.4			
13	3.4		3.7	
14¶	6.0		249	4.6
15	5.1			
16	5.1		583	
17†	8.3		608	
18	10.8		121	
19¶	10.8			
20	216		158	
21	222			227
22	222			
23¶	10.2			224
24	14.2			108
25	7.7			
26	15.4			
27				62
28				
29				
30‡				

*Operated upon.
†Jaundice first noted.
‡Died 9:45 a.m.

¶BLOOD COUNT

8th Day
RBC.....5,218,000
WBC.....12,700

12th Day
RBC.....6,800,000
WBC.....10,800
Polys.....20%
Lymphos.....61%
L. monos.....9%
Baso.....1%
Stabs.....2%
Shift.....8%

14th Day
RBC.....5,580,000
WBC.....11,000
Polys.....16%
Lymphos.....75%
L. monos.....4%
Baso.....4%
Eosin.....1%
Stabs.....12%
Nucleated RBC....5
Stippled RBC about 200
Polychromasia RBC varied slightly in size and shape.

19th Day
RBC.....5,140,000
WBC.....17,150
Polys.....43%
Lymphos.....41%
L. monos.....10%
Baso.....4%
Eosin.....2%
Stabs.....7%
Shift.....16%
Nucleated RBC...15
Stippled RBC....40
Polychromasia RBC varied slightly in size and shape

23rd Day
RBC.....5,380,000
WBC.....17,330
Polys.....38%
Lymphos.....39%
L. monos.....12%
Eosin.....1%
Baso.....9%
Transitional.....1%
Stabs.....6%
Shift.....16%
Nucleated RBC...17
Stippled RBC....44
Polychromasia RBC varied slightly in size and shape

27th Day
RBC.....5,360,000
WBC.....10,350
Polys.....53%
Lymphos.....31%
L. monos.....5%
Baso.....11%
Stabs.....8%
Shift.....15%
Nucleated RBC....1
Stippled RBC.....0

gether with reticular fibers, separates the hepatic parenchyma from the intralobular capillaries, so that in reality body fluids of the vascular system actually bathe the parenchyma cells as they circulate through the hepatic lobule. . . . Phagocytosis characterizes the functionally active Kupffer cell. . . . It seems clear the Kupffer cells of the liver are a part of the changing system of histiocytes or macrophages which have been designated the reticulo-endothelial system."

Accepting Mann's conclusions as to the Kupffer cells' nature and function, it is not unreasonable to assume that their physiological activity may have an even further reaching effect than this assumption includes. As far back as 1928, Jaffé and Berman, of the University of Illinois Medical School, demonstrated that these cells are largely concerned in the metabolism of fat. In the course of their experiments rabbits were thyroidectomized and injected with fat droplets. The results showed that lack of the thyroid interferes with the quick elimination of the fat droplets through the liver. These observations clearly point to activity of the reticulo-endothelial system of the liver in the regulation of blood iodine, even though research has not yet been far enough extended to produce positive proof.

Some of the autopsy reports upon patients who died in the "liver death" syndrome are of interest in this connection. Heuer speaks of the "quite consistently striking degenerative changes in the liver and kidneys. The liver showed leucocytic infiltration, necrosis, and interstitial hemorrhages, or marked parenchymatous and fatty changes, most marked about the gall-bladder fossa." Schutz and his co-workers found "either leucocytic infiltrations, necrosis, and interstitial hemorrhages, or marked parenchymatous and fatty changes." And "in all instances in which gall-bladder disease was the reason for surgical intervention," these authors obtained "a history of long standing cholecystitis and, at both the operation and the necropsy, liver

TABLE IV.—BLOOD IODINE[1] BEFORE OPERATION

No.	Date	Gamma 1–100 c.cm.	Diagnosis
10	6–11–35	5.4	Nodular colloid goiter
11	6–13–35	5.4	Neurasthenic
12	6–13–35	11.4	Toxic nodular colloid
13	7– 8–35	4.4	Toxic adenoma
14	7–10–35	6.1	Tumor of pancreas
15	7–15–35	4.8	Toxic adenoma of thyroid
16	9–30–35	3.4	Nodular
17	10–27–35	4.4	Toxic adenoma
18	12– 3–35	17.7	Hyperplastic
19	12–31–35	11.9	Thyrotoxicosis
20	1– 7–36	4.4	Albuminuria, mental trouble
21	1– 7–36	35.5	Operated upon for goiter 7 months ago
22	1– 9–36	5.3	Nodular colloid
23	1– 9–36	4.0	No diagnosis given
24	1–13–36	4.0	No diagnosis given
25	1–16–36	3.3	Fibroid uterus
26	1–18–36	4.0	Nodular colloid goiter previously operated (1 yr.)
27	1–20–36	9.3	Nodular colloid
28	1–20–36	4.0	Hyperplasia, exophthalmos
29	1–21–36	5.0	Nodular colloid
30	1–27–36	6.7	Nodular colloid "syphilis"
31	1–29–36	4.3	Adenomatous thyroid and hemorrhoids
32	1–29–36	4.0	Hypertension
33	2– 1–36	34.0	Hyperplastic, has been taking Lugol's
34	2– 3–36	8.0	Diffuse nodular colloid
35	2– 3–36	5.7	Adenoma of thyroid
36	2– 3–36	3.3	Nodular colloid adenoma
37	2– 3–36	4.0	No diagnosis given
38	2– 3–36	6.4	Hyperthyroidism
39	2–10–36	3.3	Nodular colloid goiter
40	2–11–36	3.3	No diagnosis given
41	2–12–36	5.7	Cancer of uterus
42	2–12–36	649.0	Chronic cholecystitis, possible cancer of liver
43	2–12–36	119.0	Hyperplastic thyroid
44	2–15–36	5.3	Adenoma of thyroid
45	2–15–36	4.6	Hyperplastic thyroid
46	2–17–36	6.4	Nodular colloid goiter
47	2–20–36	16.6	Colloid goiter, possible gall stones
48	2–24–36	8.6	Hyperplastic goiter
49	2–25–36	13.6	Acute hydrops of gall bladder
50	2–25–36	3.3	Hyperplastic thyroid

[1] The results on patients 1–9, inclusive, are not reliable.

TABLE IV.—BLOOD IODINE BEFORE OPERATION—Continued

No.	Date	Gamma 1–100 c.cm.	Diagnosis
51	2–25–36	7.3	Nodular colloid goiter
52	2–25–36	5.0	Epigastric hernia
53	2–25–36	4.0	Nervousness
54	2–25–36	4.3	Nodular toxic goiter
55	3– 3–36	2.1	Hypothyroid
56	3– 4–36	lost	
57	3– 4–36	3.6	Hyperplastic goiter
58	3– 4–36	4.6	Retrogressive exophthalmic goiter
59	3– 4–36	9.3	Hyperplastic goiter
60	3– 7–36	4.3	Arthritis, possible cholecystitis, enlarged gall bladder
61	3– 7–36	5.3	Inguinal adenitis
62	3– 7–36	3.9	Subacute cholecystitis
63	3– 7–36	1,500.0	Subacute cholecystitis
64	3– 7–36	5.8	Acute appendicitis
65	3– 7–36	6,180.0	Common duct obstruction
66	3– 7–36	560.0	Chronic cholecystitis with stones "carcinoma"
67	3–12–36	5.3	Nervousness, constipation
68	3–12–36	4.6	Ovarian cyst, abdominal adhesions
69	3–14–36	5.5	Chronic cholecystitis with stones
70	3–16–36	9.3	Nodular colloid goiter
71	3–19–36	2,090.0	Chronic cholecystitis with stones
72	3–20–36	5.9	Colloid goiter
73	3–23–36	3.3	Cystic ovary, left
74	3–25–36	4.2	Cystic ovary, chronic appendicitis
75	3–26–36	3.9	Hyperplastic goiter
76	3–26–36	27.1	Exophthalmic goiter
77	3–28–36	5.9	Dysmenorrhea; left ovarian cyst
78	3–30–36	4.6	Prolapsed, fibroid uterus
79	3–31–36	3.9	Nodular colloid goiter
80	4– 6–36	209.0	Chronic cholecystitis and chronic appendicitis
81	4– 7–36	3.6	Menopause, hypertension
82	4– 9–36	4.3	Menses at this time, diagnosis in doubt
83	4–14–36	6.0	Umbilical hernia (ascites)
84	4–16–36	72.0	Hyperplastic nodular, colloid goiter (taken Lugol's)
85	4–17–36	4.6	Benign fetal adenoma
86	4–17–36	6.0	Benign thyroid adenoma, hypertrophy, cysts
87	4–20–36	4.6	Hyperacidity
88	4–24–36	5.6	Nodular colloid goiter
89	4–27–36	110.0	Chronic cholecystitis with cholesterosis of gall bladder
90	4–28–36	87.0	Same, after glucose administration
91	4–28–36	16.4	Hyperplastic goiter

TABLE IV.—BLOOD IODINE BEFORE OPERATION—Continued

No.	Date	Gamma 1-100 c.cm.	Diagnosis
92	4-29-36	12.9	Toxic adenoma of thyroid
93	4-29-36	23.0	Thyroid adenoma with retrograde changes
94	4-30-36	11.1	Benign fetal adenoma
95	4-30-36	3.6	Colloid goiter
96	4-30-36	4.6	Recurrent hyperplastic (thyroidectomy 1921)
97	5- 1-36	4.3	Prolapse of rectum, thrombosed hemorrhoids
98	5- 1-36	2,250.0	Obstruction of common duct
99	5- 6-36	6.3	Diffuse nodular colloid
100	5- 9-36	4.7	Chronic cholecystitis (?) no stones
101	5-11-36	4.0	Carcinoma of stomach, inoperable
102	5-13-36	3.7	No diagnosis given
103	5-13-36	3.7	Nervous exhaustion, intercostal neuritis
104	5-13-36	4.5	Sciatic, chronic cholecystitis with stones
105	5-16-36	6.9	Acute bronchitis
106	5-16-36	4.2	Acute hydrops of gall bladder
107	5-16-36	5.0	Chronic appendicitis
108	5-18-36	4.6	Chronic cholecystitis with stones
109	5-18-36	14.3	Benign thyroid adenomas and damaged heart
110	5-19-36	6.0	Portal cirrhosis of liver, ascites and jaundice
111	5-23-36	6.6	Benign thyroid adenomas with hemorrhage
112	5-25-36	5.3	Cancer of liver (nodules on liver)
113	5-25-36	3.7	No diagnosis given
114	5-26-36	4.3	Nodular colloid adenoma
115	5-28-36	5.9	Chronic cholecystitis, subacute
116	6- 3-36	3.2	Thyroiditis, Riedel's-Woody
117	6- 8-36	6.4	Nodular colloid adenoma
118	6-16-36	3.6	Uterine polyp
119	6-16-36	3.6	Tumor of left breast
120	6-16-36	8.0	Portal cirrhosis of liver, ascites and jaundice
121	6-20-36	9.0	No diagnosis given
122	6-20-36	500-18.5	Chronic cholecystitis with stones
123	6-23-36	2.9	Endocervicitis, endometritis, salpingitis and appendicitis
124	6-24-36	11.1	Benign colloid goiter; traces of fetal adenoma
125	7- 6-36	2.9	Chronic cholecystitis, subacute
126	7- 6-36	180.0	Chronic cholecystitis and chronic appendicitis
127	7-11-36	3.2	No diagnosis, enlarged gall bladder on x-ray
128	7-14-36	4.3	Carcinoma of lymph gland, highly malignant
129	7-23-36	3,310.0	Chronic cholecystitis; chronic thickening of appendix
130	7-27-36	470.0	Benign fetal adenoma, had taken iodine
131	7-28-36	13.0	Chronic cholecystitis with stones (3 wks. postoperative)
132	7-28-36	3.9	No diagnosis, complaint: pain in back

TABLE IV.—BLOOD IODINE BEFORE OPERATION—Continued

No.	Date	Gamma 1-100 c.cm.	Diagnosis
133	8-27-36	6.2	Nodular colloid goiter
134	8-27-36	19.6	Carcinoma of gall bladder
135	8-21-36	2,920.0	Chronic cholecystitis, fibrous,subacute,stones
136	9-26-36	5.2	Lymphatic leucemia
137	8-31-36	5.7	Either Hodgkin's disease or tuberculosis of lymph glands
138	9-17-36	49.5	Cholangitis, acute, due to biliary tract infection
139	9-17-36	18.7	Chronic cholecystitis with stones, postoperative
140	10- 8-36	13.1	Toxic adenoma, decompensated heart
141	10-12-36	2.5	Chronic cholecystitis, fibrous
142	10-16-36	4.9	Chronic cholecystitis with stones
143	10-21-36	3.3	Chronic sinusitis; chronic appendicitis
144	10-26-36	6.2	Nodular colloid goiter, toxic, diffuse
145	10-27-36	209.0	Hypertension; is taking Lugol's, etc.
146	11- -36	34.6	
147	11- 6-36	4.7	Chronic cholecystitis with stones
148	11- 7-36	4.2	Menopause
149	11- 7-36	11.3	No diagnosis, slightly enlarged gall bladder
150	11-13-36	6.6	Epilepsy, idiopathic
151	11-14-36	7.1	Hypertension
152	11-16-36	7.9	Adenoma of thyroid; fibroid of uterus
153	11-16-36	7.7	Hyperplastic thyroid
154	11-30-36	5.8	Hirsutism . . . hypogonadism
155	12- 2-36	4.0	Slight obesity
156	12- 8-36	5.5	Hyperplastic thyroid
157	12-11-36	8.7	Large diffuse nodular toxic thyroid
158	12-12-36	8.5	Nodular toxic colloid
159	12-14-36	3.2	Thyroid adenoma, recent focal hemorrhage
160	12-16-36	4.8	Breast . . . duct hyperplasia with inflammation
161	12-16-36	6.9	Endometrial polyp . . . postoperative
162	12-16-36	6.2	Multiple fibroids with uterine polyp
163	12-17-36	5.0	Ovarian cyst, left
164	12-23-36	8.7	Uremic poisoning, decompensated heart, etc.
165	12-23-36	5.0	Benign fetal adenoma of thyroid
166	12-28-36	6.9	Nodular colloid adenoma
167	12-29-36	5.6	Facial neuralgia
168	12-29-36	7.1	Nodular colloid goiter, had iodine 2 days ago
169	12-30-36	5.3	Hypertensive heart disease; vasomotor trouble
170	1- 2-37	27.5	Chronic cholecystitis with stones
171	1- 6-37	4.7	Chronic cholecystitis and general neurosis
172	1- 6-37	5.8	Diffuse nodular toxic colloid goiter

TABLE IV.—BLOOD IODINE BEFORE OPERATION—Concluded

No.	Date	Gamma 1-100 c.cm.	Diagnosis
173	1- 7-37	11.4	Toxic hyperplastic thyroid
174	1- 7-37	5.2	Nodular colloid goiter (?) . . . cervix
175	1- 8-37	409.0	Chronic cholecystitis with stones
176	1- 8-37	4.2	Asthenia
177	1- 8-37	6.8	Hypertension
178	1- 9-37	560.0	Chronic cholecystitis, ovarian cyst
179	1- 9-37	4.5	Bilateral salpingitis
180	1-13-37	8.2	Nodular colloid goiter, diffuse, toxic

* Persons known to have had iodine administered within 9 days preceding the drawing of the blood sample for iodine analyses are noted as being such in Table IV with the exception of patients 49, 71, 129 and 147 who had tetraiodophenolphthalein one day before drawing the blood. Later evidence leads us to think nine days is insufficient time to allow for elimination of tetraiodophenolphthalein in some liver and gall bladder cases.

damage of considerable duration was encountered." In no case did they feel they had reason to believe that death was due to *cessation* of liver function, but rather to its perversion.

It would seem not unreasonable to assume that "liver death" results from the placing of an extra strain upon a liver the Kupffer cells of which have been previously impaired. "So long as the liver is put to no strain and stress other than that of ordinary living, to which it has accustomed itself so to speak, it is quite capable of carrying on. But when operation is undertaken, an entirely different complexion is put on the matter. Even in the most favorable cases there are introduced alone or in combination, . . . the strain of the anesthetic, the trauma of surgical manipulation, the drop in intra-abdominal temperature and the changes in intrahepatic and biliary pressure. The result is that a liver which is already the seat of a pathologic process is unable to cope with the added strain and its function promptly fails . . . . the liver cells, as they become increasingly unable to fulfil their function, undergo some necrotic change, partly because of failing function and partly because of the changes in intrahepatic pressure brought about by operation" (1).

The value of the blood iodine estimation as a preliminary to any operation upon the biliary tract is indirectly emphasized by

TABLE V.—BLOOD IODINE—POSTOPERATIVE

No.	Date	Gamma in 1-100 c.cm.		Diagnosis
			P.O.	
42	2-12-36	649.0	16.6	Chronic cholecystitis, possible cancer of liver
47	2-20-36	16.6		Colloid goiter, possible gall stones
49	2-25-36	13.6		Acute hydrops of gall bladder
62	3- 7-36	3.9		Subacute cholecystitis
63	3- 7-36	1,500.0		Subacute cholecystitis
65	3- 8-36	6,180.0	Died	No operation Common duct obstruction
66	3- 8-36	560.0		Chronic cholecystitis with stones, carcinoma
71	3-19-36	2,090.0	40.0 5 wks.	Chronic cholecystitis with stones
80	4- 6-36	209.0		Chronic cholecystitis and chronic appendicitis
98	5- 1-36	2,250.0	Died	Common duct obstruction
100	5- 9-36	4.7		Chronic cholecystitis (?) no stones
106	5-16-36	4.2		Acute hydrops of gall bladder
108	5-18-36	4.6		Chronic cholecystitis with stones
110	5-19-36	6.0		Portal cirrhosis of liver with ascites and jaundice
112	5-25-36	5.3		Cancer of liver (nodules on liver)
115	5-28-36	5.9		Chronic cholecystitis, subacute
120	6- 1-36	8.0		Portal cirrhosis of liver, ascites, and jaundice
122	6-20-36	500.0	18.5 2 wks.	Chronic cholecystitis with stones
125	7- 6-36	2.9		Chronic cholecystitis, subacute
126	7- 6-36	180.0	32.0 4 wks.	Chronic cholecystitis and chronic appendicitis
127	7-11-36	3.2		No diagnosis, enlarged gall bladder on x-ray
129	7-23-36	3,310.0		Chronic cholecystitis, chronic thickened appendix
131	7-28-36	13.0		Chronic cholecystitis with stones
134	7-28-36	19.6		Carcinoma of gall bladder
135	8-21-36	2,920.0	50.0*	Chronic cholecystitis, fibrous, subacute, stones
138	9-17-36	49.5	6.4	Cholangitis, acute due to biliary tract infection
139	9-17-36	18.7		Chronic cholecystitis with stones, postoperative
141	10-12-36	2.5		Chronic cholecystitis, fibrous
142	10-16-36	4.9		Chronic cholecystitis with stones
147	12- 6-36	4.7		Chronic cholecystitis with stones
149	11- 7-36	11.3		None; slightly enlarged gall bladder
170	1- 2-37	27.5		Chronic cholecystitis with stones
171	1- 6-37	4.7		Chronic cholecystitis and general neurosis
175	1- 8-37	409.0		Chronic cholecystitis with stones
178	1- 9-37	560.0	8.5 1 mo.	Chronic cholecystitis, ovarian cyst

Schutz and his colleagues when they state that "it is difficult, if not impossible to estimate the degree of liver damage which is present prior to operation, since it is rather definitely demonstrated that the liver function, so far as its physiologic activity is concerned, is not disturbed."

Several years ago Graham proposed a roentgenological dye test. He had observed that in patients who died "liver deaths" following relatively simple operations on the biliary tract, there had always been high retention of the dye used in the pre-operative x-ray examination. "We have noted," he says, "a striking reduction in our operative mortality in cases of disease of the biliary tract since we began to pay attention to the information provided for us by testing the excretory function of the liver."

We feel that our plan of estimating the blood iodine, giving a correct interpretation of the relation of the liver to the storage of iodine in the blood, is of higher value than any of the tests previously recommended.

SUMMARY

The observation that cholecystitis, cholelithiasis, and hepatitis are invariably accompanied by a high iodine content of the blood suggested the use of the blood iodine estimation as a measure of liver efficiency. Animal experimentation was undertaken to ascertain whether operations upon the biliary tract influenced the blood iodine, and if so, to what extent. The results of this experimentation are set forth in tabular form.

The information thus gained is of interest in connection with the so called "liver deaths," concerning which much has appeared in recent medical literature. The autopsy findings in such cases throw light upon the part played by the liver in the metabolism of iodine, and also in some instances, suggest exactly what part of the hepatic structure may be concerned in this metabolism. It is the author's belief that iodine metabolism is the function of the stellate cells of Kupffer. References to literature tending to confirm this theory are cited.

Reference is made to present day tests of liver function which are now employed as preliminaries to operation upon the gall bladder and ducts. The estimation of blood iodine adds another very valuable test to those now in use.

REFERENCES

1. Boyce, F. F., and McFetridge, E. M. So-called "liver death"; clinical and experimental study. Arch. Surg., 1935, 31: 105.
2. Curtis, G. M. Iodine relationships of thyroid disease. Surg., Gynec. & Obst., 1936, 62: 365.
3. DeCourcy, J. L. Blood iodine studies in cholecystic disease. In press.
4. Doetsch, H. Untersuchungen ueber die Beziehungen zwischen Schilddruese und Leber. Biochem. Ztschr., 1935, 279: 233.
5. Graham, E. A. Estimating risk of operations on biliary tract by testing excretory function of liver. Radiology, 1933, 21: 191.
6. Heuer, G. J. Factors leading to death in operations upon gall-bladder and bile-ducts. Ann. Surg., 1934, 99: 881.
7. Jaffé, R. H., and Berman, S. L. Relations between Kupffer cells and liver cells; functional studies. Arch. Path., 1928, 5: 1020.
8. Mann, F. C. Cytology of the Liver and its Special Significance. Vol. 1, p. 335. New York: P. B. Hoeber, Inc. 1932.
9. Perkin, H. J., Lahey, F. H., and Cattell, R. B. Blood iodine studies in relation to thyroid disease. New England J. Med., 1935, 214: 45.
10. Repetto, E. Ricerche sperimentali sulle correlazioni funzionali fra tiroide e fegato. Arch. ital. di chir., 1935, 40: 564.
11. Rowe, A. W. Endocrine studies: association of hepatic dysfunction with thyroid failure. Endocrinology, 1933, 17: 1.
12. Schutz, C. B., et al. A contribution to the study of so-called liver death. J. Am. M. Ass., 1932, 99: 633.
13. Weller, C. V. Hepatic lesions with exophthalmic goitre. Tr. Ass. Am. Physicians, 1930, 45: 71.

THE EFFECT OF SURGICAL DRAINAGE ON KIDNEYS DECLARED FUNCTIONLESS BY PRESENT TESTS OF RENAL FUNCTION

MAURICE GEORGE SCHULHOF, M.D., M.S., Rochester, Minnesota

INTRODUCTORY NOTE BY HUGH CABOT, M.D., F.A.C.S.

The term "functionless kidney" has been occurring in urological literature with increasing frequency since the development and perfection of a variety of methods of testing kidney function, the most recent of which is that of intravenous urography. It has not, I think, been sufficiently appreciated that the word "functionless" used in this connection should be taken literally. These tests do show that there is no evidence of function. On the other hand, they cast little or no light upon anatomical facts, which in the last analysis are of controlling importance. The great majority of these cases are associated with and apparently due to obstruction, commonly at the ureteropelvic junction, but also in other portions of the ureters above the bladder.

Another point of importance is the extraordinary and as yet unexplained influence of a stone in the kidney upon the evidence of renal function as tested by our present inaccurate methods. It has been well known for many years that a relatively small stone lying in the kidney and not producing any high grade obstruction may yet depress function to an extent wholly misleading if this evidence be relied upon. Now the experimental work upon the effect of obstruction of the ureter, partial or complete, upon the kidney has been somewhat contradictory. The older assumption that complete obstruction of the ureter was followed by atrophy of the kidney has been disproved. That some degree of hydronephrosis regularly occurs seems practically certain.

The most important and often the most difficult point upon which to get accurate information is the extent to which recovery of function will take place following satisfactory relief of the obstruction. The theory that once hypertrophy of the opposite kidney has developed, the damaged kidney will not again regain some portion of its functional capacity has been advanced and has considerably affected our plans of treatment. Many surgeons have had clinical evidence which led them to doubt the soundness of this conclusion, but such experiences are notoriously unreliable in so far as they depend upon evidence not based upon accurate and prolonged studies which enable us to state the apparent functional capacity of the kidney before relief of the obstruction and over a considerable period following the more or less complete relief of the impediment.

At my suggestion, Dr. Schulhof has undertaken a most painstaking review of a large group of cases in which great or apparent complete loss of function existed and in which the obstruction was removed. His study has required him to exclude from his conclusions the great majority of the cases on the grounds that they were due: (1) to the presence of stone, thereby introducing an incalculable factor, or (2) because though the evidence of restoration of function was clinically satisfactory, there was incomplete pre-operative or postoperative study upon which to base a conclusion. It has thus occurred that he has selected for the basis of his conclusions a relatively small group of cases. In these cases, however, the pre-operative and postoperative evidence seems very complete. His study appears to me to remove quite satisfactorily from the realm of impression and personal opinion the problem here studied. The paper seems to be important as putting upon a solid basis the opinion held by many observers that

From the Department of Surgery, The Mayo Foundation. Submitted to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Surgery.

very great recovery of function can be obtained and that many kidneys having no apparent functional value can be restored to a degree of usefulness, which is of first class importance to the patient.

THE present study was undertaken in order to supply clinical evidence on which to base an opinion that certain kidneys pronounced functionless by present methods of determining renal efficiency will respond to surgical drainage and display sufficient functional capacity to merit their conservation.

It has been the contention of some workers, notably Hinman, that such rehabilitation does not take place. He stated: "The healthier side will gradually undergo compensatory hypertrophy which may be so capable of counterbalance as to render the work of its weak assistant unnecessary, disuse atrophy of which will progressively occur. The reapportionment of functional activity after alteration occurs by a competitive type of anatomic compensation." While his contribution is an excellent one, and has been the stimulus for further investigation, similar results have not been obtained by other careful workers in this field. Joelson, Beck, and Moritz in their study were unable to agree with Hinman's conclusions. Their experiments did not demonstrate any renal atrophy of disuse, and, in fact, strongly suggested that such atrophy does not occur. They said: "In view of the experimental data, the theory of renal counterbalance need not be seriously considered in deciding the surgical treatment for certain renal lesions."

Clinically, there has been lack of confirmation of Hinman's theory that when renal function is disturbed by obstruction on one side, atrophy of disuse follows when the obstruction is removed and the kidney is placed in functional competition with its hypertrophied fellow on the opposite side. Gutierrez asserted that it was remarkable to note the functional powers of regeneration possessed by a kidney with hydronephrosis. Walters concluded that there was a remarkable return of renal function after the removal of obstructing lesions. Crosbie and Dix asserted that there were many cases in which excessive renal destruction and low function gave rise to the question of nephrectomy, but that many times after prolonged drainage sufficient function returned to make it worth while to save the kidney.

PLAN OF STUDY

In order to ascertain the number of, and to study statistically, kidneys declared functionless and treated by conservative surgical drainage, it was necessary to review all the cases in which nephrostomy, pelviostomy, or ureterostomy had been performed at the clinic. In this review, all cases in which renal calculi were present were excluded, since it is generally agreed that abeyance of function in such kidneys may be explained on the assumption of "reflex anuria," and hence such kidneys are not truly functionless. Another group of cases, including those in which uretero-enterostomy was done, and of which there were a considerable number, were not studied because of obvious difficulties in determining postoperative renal function.

Procedure. A detailed history was obtained in all cases in this series, a thorough physical examination was performed, and special studies as well as routine laboratory tests were made when indicated. A separate urologic investigation was carried out.

Roentgenograms of the urinary tract were made in all cases, the first of renal regions and upper portions of the ureters, another of the lower portions of the ureters, bladder, and prostatic region. This study revealed the presence, size, and position of the kidneys, and opaque shadows in the renal, vesical, or prostatic areas; occasionally, vesical filling defects were also noted, the vesical urine serving as contrast medium.

Preliminary to cystoscopic examination, blood urea and combined phenolsulphonphthalein determinations were made, and on introduction of the cystoscope, the presence of any residual urine was noted. The ureters were catheterized, with aspiration of the renal pelves to ascertain retention. Indigocarmine or differential phenolsulphonphthalein studies were carried out and retrograde pyelograms made when indicated. Sterile specimens of urine from each kidney were

examined routinely, freshly stained smears of the centrifuged sediment were searched for organisms, and a portion of each specimen was cultured. Immediately preceding the making of urograms, roentgenologic examination of the urinary tract was repeated. Following the intravenous injection of the contrast medium, films were taken at intervals of 5, 15, 30, and 60 minutes. Some "delayed films" were made after 2 hours. Roentgenograms were made with the compression bag in place, the pressure being removed after the 15 minute exposure. Upright, horizontal, and delayed films were made in cases in which there was a history of postural relief of pain and in which it was suspected that there was abnormal mobility of the kidneys. This was done in order to determine the degree of renal excursion as well as the presence of inadequate drainage from the renal pelvis.

In the group of cases finally selected for study, the diagnosis of functionless kidney was based on the history, physical examination, laboratory studies, including indigocarmine and phenolsulphonphthalein tests, cystoscopic investigation, and roentgenographic examination by means of intravenous urography.

Following surgical intervention the daily output of urine was noted, and the preoperative tests were repeated for purposes of comparative study.

REPORT OF CASES

CASE 1. A woman, 31 years of age, presented herself at the clinic in 1930 with a history of dull pain in the lower left abdominal quadrant for a period of 3 or 4 years. There was definite tenderness in the left costal angle on palpation. The urine contained pus, grade 2, but on culture was negative. The value for urea was 24 milligrams per 100 cubic centimeters of blood. Cystoscopic examination revealed mild, chronic cicatricial urethritis. Indigocarmine appeared from the right kidney in 7 minutes in a concentration of grade 2; no dye was seen to come from the left side in 15 minutes. Retrograde pyelograms disclosed bilateral hydronephrosis of grade 4. A diagnosis of bilateral hydronephrosis and functionless left kidney was made. Left nephrostomy was performed immediately.

During convalescence, which was uneventful, from 400 to 700 cubic centimeters of urine drained from the kidney; the specific gravity varied from 1.007 to 1.011. Infection continued, as was evidenced by the presence of pus, grade 2, in the urine; cultures of urine, however, continued negative. Indigocarmine appeared from the right side in 12 minutes in a concentration of grade 2; there was an identical appearance time and concentration on the left. The postoperative intravenous urograms revealed a fair concentration of medium in the 20 minute film on the left and normal visualization on the right. The bilateral hydronephrosis of grade 4 persisted. In a recent letter the patient said that except for an occasional ache in the left lower quadrant she was enjoying good health. The nephrostomy tube was removed after 4 months, and functional studies revealed a concentration of indigocarmine of grade 2+ in 10 minutes from both sides. The intravenous urograms were described as unchanged except that the pelvis of the left kidney had contracted down to within normal limits.

CASE 2. A man, 27 years of age, was admitted to the clinic in 1930 with the complaints of burning and frequency of urination, hematuria, and a dull pain in the left lumbar region for 6 months. Roentgenograms of the kidneys, ureters, and bladder were negative. The vesical urine contained erythrocytes, grade 3, and pus, grade 3. Culture of the urine gave a growth of Proteus ammoniæ and Escherichia coli. A combined phenolsulphonphthalein test disclosed a return of 35 per cent of the dye. Cystoscopy revealed a real cystitis, of grade 2, and clear spurts from the right ureteral orifice; the left orifice could not be located. A differential function test with indigocarmine showed a concentration of grade 4 in 5 minutes on the right, and a total absence of secretion of dye on the left in 15 minutes.

A diagnosis of infected hydronephrosis with functionless left kidney was made. Nephrostomy was performed through the middle calyx. Following operation the output of urine from the left kidney rose to between 200 and 1350 cubic centimeters for 24 hours; the specific gravity of the urine varied from 1.005 to 1.008. The daily excretion of urine from the right kidney varied from 525 to 2550 cubic centimeters, and it had a specific gravity of from 1.010 to 1.012. A differential phenolsulphonphthalein test gave a 50 per cent return of dye from the bladder and 30 per cent from the left kidney. The patient was dismissed in excellent condition with the nephrostomy tube in place. The tube was removed by the patient's local physician 11 months later and the wound healed nicely. At that time the patient was free of symptoms and able to carry on his daily work.

CASE 3. A woman, 43 years of age, was admitted to the clinic in 1930 because of recurrent left lumbar pain of 11 months' duration. In the month prior to her arrival at the clinic, she had noted blood in her urine on several occasions. Erythrocytes, grade 4, and pus, grade 3, were noted in the urine, but no organisms were grown on culture. There was dilatation, grade 2 to 3, of the pelvis and calyces on the right in the 20 minute urogram, and indications of good function. A trace of medium was present over the left renal pelvis in the 60 minute film. On cys-

toscopy clear spurts were seen to come from the right kidney. No flux was noted from the left ureteral orifice in 10 minutes. A differential indigocarmine test gave a return of dye from the right side in 7 minutes in a concentration of grade 4; there was no appearance of the dye from the left side in 15 minutes. A diagnosis of bilateral hydronephrosis and functionless left kidney was made.

Resection of the left renal pelvis and nephrostomy were performed. The urinary output after operation was between 600 and 1350 cubic centimeters daily from the left kidney, the urine having a specific gravity of from 1.006 to 1.013. The 24 hour specimen of urine from the right kidney measured from 400 to 1500 cubic centimeters, its specific gravity ranging from 1.008 to 1.012. The value for urea was 24 milligrams per 100 cubic centimeters of blood. A differential function test with indigocarmine showed a concentration, grade 3, from the right kidney in 8 minutes and a concentration of grade 2 from the left kidney in 9 minutes. There was a good concentration of medium on both sides in the 20 minute intravenous urogram. There was bilateral dilatation of the pelvis and calyces, grade 2. The nephrostomy tube was removed 2 months after operation.

The patient returned to the clinic in 1933. At that time, an intravenous urogram was done, and pelves and calyces on both sides were well visualized in the 5 minute film. Caliectasis, pyelectasis and ureterectasis, grade 2, were still present as in previous examinations. The patient said that she had been enjoying excellent health and that her strength and endurance were good.

CASE 4. A woman, 34 years of age, was admitted to the clinic in 1931 with a history of left renal colic, and a mass in the left upper abdominal quadrant for the previous year. Her urine contained pus, grade 2, and culture gave a growth of Escherichia coli and Pseudomonas. The blood contained 16 milligrams of urea per 100 cubic centimeters.

Roentgenograms of the kidneys, ureters, and bladder were negative. Cystoscopic examination of the bladder revealed normal findings. Indigocarmine appeared from the right kidney in a concentration of grade 4 after 5 minutes; no dye was recovered from the keft kidney after 15 minutes. Pyelograms revealed dilatation of the pelvis, calyces and ureter, grade 3, on the left and grade 1 on the right. In the intravenous urograms visualization was absent on the left at the end of 60 minutes; function was unimpaired on the right. Left nephrostomy was performed, the Cabot technique being used.

The operative convalescence was uneventful. Specimens of urine from the renal stoma contained erythrocytes, grade 1, and pus, grade 1; the vesical urine contained pus, grade 1. Pseudomonas organisms were cultured from this urine. The output of urine from the bladder ranged from 1000 to 1,900 cubic centimeters, its specific gravity being from 1.007 to 1.023. The left kidney excreted between 550 to 1040 cubic centimeters of urine each 24 hours, with a specific gravity of from 1.004 to 1.013. Two weeks following operation, a differential phenolsulphonphthalein test showed a recovery of 55 per cent of the dye from the right and 23 per cent from the left. Intravenous urograms taken 6 months later gave fairly good visualization of the left kidney in the 20 minute film and showed hydronephrosis of grade 3; there was good concentration of medium on the right, showing hydronephrosis of grade 1. In a letter the patient's local physician 2 years later said that the patient had gained considerable weight and that her general physical condition had been unusually good.

CASE 5. A man, 45 years of age, came to the clinic in 1931 because of attacks of pain in the left lumbar region of 8 years' duration. Roentgenograms of the bladder, kidneys, and ureters were negative. The value for blood urea was 56 milligrams per 100 cubic centimeters. The urine contained erythrocytes, grade 2, and pus, grade 4. Cultures of urine revealed Proteus ammoniæ. Cystoscopic examination was essentially negative. Differential function tests with indigocarmine revealed a concentration of grade 2 in 15 minutes on the right and a total absence of secretion of dye on the left. Intravenous urograms revealed faint visualization on the right in the 20 minute film and no evidence of medium on the left in the 60 minute exposure. On retrograde pyelography, bilateral hydronephrosis, grade 4, was demonstrated. A diagnosis was made of bilateral infected hydronephrosis, with a functionless left kidney and a reduction in function on the right.

Bilateral nephrostomy was performed. Immediately following operation, each kidney excreted between 800 and 1000 cubic centimeters of urine in 24 hours, with a range in specific gravity from 1.004 to 1.010. Daily microscopic examination revealed moderate infection. Two weeks following operation, 20 per cent of phenolsulphonphthalein was recovered from each kidney. At the time of dismissal, 1 month later, the value for urea was 42 milligrams per 100 cubic centimeters of blood.

In 1933, 2 years later, the patient returned to the clinic because of another complaint (cholecystitis). He volunteered the information at this time that his kidneys had given him no further trouble. Both renal stomas were functioning well and had given him no discomfort. The urine contained pus, grade 1, and the value for blood urea was 38 milligrams per 100 cubic centimeters.

CASE 6. In 1930 a man, 34 years of age, presented himself at the clinic with the history of pain in the right lumbar region and backache for several years. Pus, grade 2, was present in the urine, but no growth was obtained on culture. A roentgenogram of the genito-urinary tract showed no abnormal shadows in the region of the kidneys, ureters, or bladder. A minute amount of medium was noted in the 60 minute intravenous urogram over the right renal area, while on the left, visualization and outline were normal in the 5 minute exposure. The value for urea was 20 milligrams per 100 cubic centimeters of blood. On cystoscopic examination, the right

ureteral orifice could not be seen, but clear spurts were seen to come from the left ureteral orifice. Indigocarmine appeared from the left in a concentration of grade 4 in 5 minutes, and was absent from the right in 15 minutes. A 40 per cent return of dye was obtained on the combined phenolsulphonphthalein test. A diagnosis of functionless right kidney was made and exploration was advised.

Nephrostomy was performed. The daily urinary output from the kidney varied from 850 to 1050 cubic centimeters, with a specific gravity of from 1.006 to 1.012. The left kidney excreted from 200 to 1800 cubic centimeters of urine daily, with a specific gravity of from 1.007 to 1.016. The value for blood urea remained stationary. Twenty-three per cent of phenolsulphonphthalein was returned from the right kidney and 52 per cent from the bladder with the differential test. Visualization was good on both sides in the 15 minute urogram; the pelves, ureters, and calyces were within normal limits. The nephrostomy tube was removed 1 year later, at which time the patient was doing his usual work.

CASE 7. A man, aged 48 years, came to the clinic in 1934 complaining of dysuria, frequency of urination, and hematuria of 3 years' duration. His urine contained erythrocytes, grade 1, and pus, grade 4, and on culture was found to contain micrococcus. The value for blood urea was 22 milligrams per 100 cubic centimeters. Cystoscopy disclosed an infiltrating tumor, involving the right lateral and posterior wall of the bladder, and also a suggestion of infiltration on the left lateral wall close to the sphincter. The pathologic diagnosis was squamous-cell carcinoma, grade 4 (Broders' method). Because of the extreme intolerance of the bladder it was deemed inadvisable to continue with further examinations and differential tests were not made. Urographic studies on the left revealed dilatation of the calyces, pelvis and ureter, grade 2, with normal function. On the right there was no visualization of medium in any film, including the 60 minute one. A diagnosis of squamous cell carcinoma of the bladder, bilateral hydronephrosis, and functionless right kidney was made.

Bilateral cutaneous ureterostomy was performed. The urinary output for 24 hours on the left was from 1000 to 1500 cubic centimeters, with a range of specific gravity from 1.010 to 1.015. On the right the daily excretion was from 750 to 1,000 cubic centimeters, and the specific gravity varied from 1.012 to 1.014. A differential phenolsulphonphthalein test gave a return of 39 per cent on the left and 19 per cent on the right. The value for blood urea remained normal (18 milligrams per 100 cubic centimeters). Retrograde pyelograms taken 2 weeks after operation disclosed a normal pelvis and calyces, with dilatation of the ureter, grade 2, on the right; and normal pelvis, calyces, and ureter on the left. Intravenous urograms revealed beginning visualization on both sides in the 5 minute film, and good visualization in the 20 minute film with outlines coinciding closely with those in the pyelograms. A course of deep roentgen therapy was given as soon as the post-operative condition would permit. The patient returned for re-examination 4 months later. Intravenous urography revealed no change and the function of both kidneys on this basis was thought to be good. It was learned that this patient died 14 months later.

CASE 8. In 1935 a girl, 9 years of age, was brought to the clinic having had pain in the left flank since the age of 5 years. A catheterized specimen of urine was negative on routine examination but on culture the Escherichia coli was obtained. The blood urea was 20 milligrams per 100 cubic centimeters. Ordinary roentgenograms of the kidneys, ureters, and bladder were negative. There was a normal appearance time and concentration of medium on the right in the intravenous urogram. The outlines of the pelves, calyces, and ureters were within normal limits. On the left there was only a faint suggestion of medium in the 60 minute film. A diagnosis of left hydronephrosis and functionless kidney was made.

Plastic repair of the renal pelvis was carried out, followed by decapsulation and a Cabot type of nephrostomy. The output of urine from the left kidney varied from 100 to 850 cubic centimeters for 24 hours. The daily output from the bladder ranged from 250 to 1,200 cubic centimeters. Undoubtedly a portion of urine excreted by the left kidney passed into the bladder. The specimens from the bladder and nephrostomy tube were negative microscopically. Culture continued to show the Escherichia coli in urine from both kidneys. The value for urea was 24 milligrams per 100 cubic centimeters of blood. Intravenous urograms taken 3 weeks after operation disclosed beginning visualization on both sides in the 5 minute film, good concentration on the right in the 20 minute exposure, and best visualization on the left in the 60 minute film. The left calyces, pelvis, and ureter were dilated, grade 2+; the right kidney was normal. This patient has not been heard from since dismissal.

CASE 9. In 1935 a man, 58 years of age, came to the clinic with the complaints of dysuria, frequency, and hematuria for 1 year. An ordinary roentgenogram of the abdomen was negative. The blood urea was 40 milligrams per 100 cubic centimeters. The urine contained erythrocytes, grade 1, and pus cells, grade 2. Aerobacter aerogenes was cultured from the urine. Cystoscopic examination revealed a grade 4 squamous cell epithelioma of the base and left wall of the bladder in the region of the left ureter. No spurt was seen to come from the left ureter. The intravenous urograms were normal on the right. There was no evidence of medium on the left in any film, including the 60 minute one. Suprapubic cystostomy was done with fulguration of the lesion and insertion of radon seeds. Three months later, bilateral cutaneous ureterostomy was performed. Immediately following this operation the daily urinary output on the left ranged from 100 to 500 cubic centimeters, with a specific gravity of from 1.006 to 1.017. On the right, the 24 hour output was from

450 to 3,400 cubic centimeters, with a specific gravity of from 1.008 to 1.010. The phenolsulphonphthalein test showed a return of 15 per cent of the dye on the left and 29 per cent on the right. The intravenous urogram revealed normal outlines, appearance time, and concentration of medium on both sides. The value for blood urea was 36 milligrams per 100 cubic centimeters. The patient was dismissed 3 months following the second operation with the ureteral stomas functioning well.

CASE 10. A man, 52 years of age, registered at the clinic in 1934 with a history of pain in the left flank and intermittent hematuria for 3 or 4 years. The urine contained pus, grade 1, and on culture gave a growth of Escherichia coli and Proteus ammoniæ. The value for urea was 44 milligrams per 100 cubic centimeters of blood. Intravenous urograms revealed no visualization on the left in any film. The right side was normal in outline, appearance time, and concentration of medium. A diagnosis of functionless, infected left kidney and hydronephrosis was made, and left nephrostomy was performed. On the nineteenth postoperative day an intravenous urogram was made. There was fair visualization on the left in the 5 minute film, concentration of the medium being best in the 20 minute film. The outline of the kidney was normal except for slight dilatation of the middle calyx. The right kidney appeared normal as before. The urine contained pus, grade 3, and on culture of urine from the nephrostomy tube Escherichia coli and Proteus ammoniæ were found. The urinary infection was cleared up before the patient was dismissed; on dismissal the nephrostomy tube was still in place. Three months later the tube was removed by the patient's local physician, and one year after his dismissal the patient wrote that he was enjoying good health and was free of symptoms.

SUMMARY

In 260 cases in which surgical drainage was performed on the kidney for conditions other than lithiasis, 40 operations were performed on apparently functionless kidneys. Of this group, 10 cases were selected because relatively complete studies were carried out which appeared to authorize the drawing of conclusions. It will be noted that the 10 cases are divided into 2 groups: the first 6 cases comprising a group in which complete preoperative and postoperative studies were made, the last 4 a group in which intravenous urography alone was used as a test of differential function.

In these 10 cases 4 of the patients were females, 6 males. The average age at the time of operation was 38 years, the youngest patient being 9 years old and the oldest, 52. The average age at the onset of symptoms was 35 years. Thus the average time which elapsed between the onset of symptoms and operative intervention was 3 years. Although it is impossible to state with any accuracy the length of time during which renal function had been impaired in these cases, it was doubtless sufficiently long to produce compensatory hypertrophy.

In 9 cases there was pus in the urine. Positive cultures were obtained in 6 cases, Escherichia coli being the predominating organism. Pseudomonas, Proteus ammoniæ, Aerobacter aerogenes and micrococci were other offenders. In 4 cases in which Escherichia coli had been demonstrated before operation, it could not be cultured from the postoperative specimens. The value for blood urea was normal in 8 cases before operation, abnormal in 2. In 8 cases the left kidney was involved, in 2 the right kidney. In 8 cases nephrostomy was performed, while in the 2 remaining cutaneous ureterostomy was resorted to. In 5 cases in which both dye tests and intravenous urography were employed to ascertain differential renal function, there was close agreement between the 2 concerning the state of renal efficiency. In most cases the period of time which elapsed between the operation and the postoperative tests of renal function was about 20 days.

Effect of drainage. Definite improvement was noted in renal function in each of the 10 cases as a result of surgical drainage. In 4 cases the drained kidney functioned equally as well as the opposite kidney; in 5 cases function returned to approximately 50 per cent of that of the other side; and in 1 case function returned to the extent that good visualization was delayed to the 60 minute intravenous urogram.

CONCLUSIONS

It appears from this study that Hinman's theory of renal counterbalance is not supported by the clinical evidence. On the basis of the tests which were here applied, the kidneys were found to be functionless, but following surgical drainage there was a return of function.

A kidney cannot be declared functionless by these tests short of determining its complete

absence or complete destruction, and the only useful criteria of the extent of renal function, therefore, would appear to be exploration and drainage.

Many so called functionless kidneys are valuable and should be preserved.

REFERENCES

1. Crosbie, A. H. The rôle of nephrostomy in genito-urinary surgery. J. Urol., 1925, 14: 249–252.
2. Dix, V. W. Some observations on temporary drainage of the kidney. Proc. Roy. Soc. Med. (Pt. 2), 1933, 26: 1072–1076.
3. Gutierrez, Robert. Hydronephrosis. In: Hugh Cabot's Modern Urology. 3d ed., vol. 2, 414–457. Philadelphia: Lea & Febiger, 1936.
4. Hinman, Frank. Renal counterbalance. Arch. Surg., 1926, 12: 1105–1223.
5. Joelson, J. J., Beck, C. S., and Moritz, A. R. Renal counterbalance. Arch. Surg., 1929, 19: 673–711.
6. Walters, Waltman. Restoration of renal function following removal of obstructing lesions. Ztschr. f. urol. Chir., 1933, 36: 264–275.

LOW BACK PAIN AND SCIATICA

Its Etiology, Diagnosis, and Treatment

A. GURNEY KIMBERLEY, M.D., D.Sc. (Med.), Portland, Oregon

A GREAT number of anatomical variations may exist at the junction of the lumbar spine with the sacrum. Whether or not these are incomplete evolutional changes attempting to adjust man to his erect posture and orthograde gait is of no clinical importance, but the fact that they exist is in part responsible for the frequency of low back pain and accompanying sciatica.

Under the soundest of mechanical arrangements one encounters at the lumbosacral junction, it is still the most vulnerable portion of the spine and is subjected to the greatest strain. It is the meeting place of an articulated column (the spine) with a relatively immovable structure (the pelvis). The axis of body weight falls anterior to the lumbosacral juncture and makes an angle with a line bisecting the first sacral vertebra to a degree proportional to the obliquity of the upper surface of the sacrum with the horizontal. The lumbosacral joints must bear the body weight and, in addition, any weight lifted by the upper extremities or borne upon the shoulders. Often lifting is done near the extremes of motion permitted by the spinal joints, so that its leverage is great and the resultant stresses magnified. Faults of posture increase the stresses present in proportion as they shift the axis of weight bearing from a center passing through the lumbosacral junction.

The foramina between the sacrum and the fifth lumbar vertebra are usually the smallest of the intervertebral foramina, yet they contain the largest of the spinal nerves. These nerves, together with their surrounding plexus of veins, almost fill the canals. The walls of the bony canal through which the fifth lumbar nerve passes are of peculiar interest, for posteriorly are the posterior spinal articulations, antero-internally the intervertebral disc, and postero-externally the lumbosacral and iliolumbar ligaments. The dorsal primary division of the nerve turns backward to supply the sacrospinalis muscle, and in its course runs close to the lateral aspect of the posterior articulation supplying the joint capsule itself.

These relationships make it possible for the fifth lumbar nerve to be affected by the slightest of inflammatory changes in the posterior articulations, by extrusions of the annulus fibrosus or nucleus pulposus, by any change in shape or size of the canal secondary to displacement of the fifth lumbar on the sacrum or atrophy of the intervertebral disc. A somewhat comparable situation is faced by the fourth lumbar nerve, which, however, is smaller and its foramen slightly larger.

Ligamentous and muscular injuries following excessive strains or unexpected loads, or the gradual weakening of soft tissue supports that come as the individual recedes from his prime may throw upon this vulnerable area a load it is not prepared to assume, and there result the symptoms and signs of lumbosacral strain.

The slight margin of safety present in the asymptomatic individual by reason of soft tissue support is further jeopardized by: (1) anatomical variations from the normal which either cause increased motion at the expense of stability, or, by reason of their asymmetry, produce abnormal stresses; (2) degenerative changes, a resultant of the excessive trauma to which this area is subjected.

ANATOMICAL VARIATIONS IN THE POSTERIOR ARTICULATIONS

The articulations between the lumbar vertebræ are in the sagittal plane. At the lumbosacral juncture the plane of the joints may range from the sagittal to the coronal. The latter allows rotation and more lateral motion, as well as flexion and extension, but does so at the expense of stability. The tilt of the articulations often varies on the two sides;

From The New York Orthopædic Dispensary and Hospital; now at Portland Clinic.

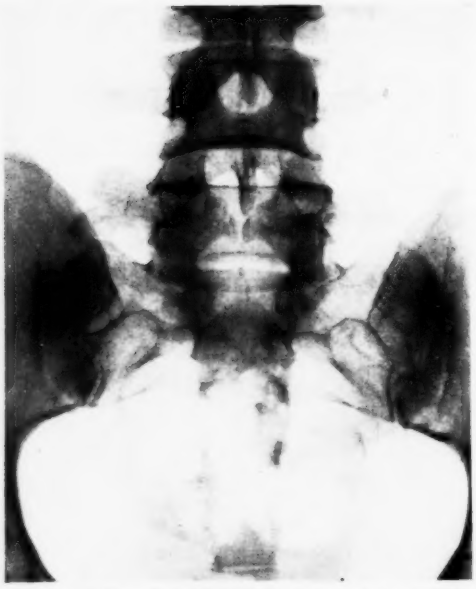


Fig. 1. Illustrating absolute asymmetry of the posterior lumbosacral articulations and a spina bifida occulta, findings corroborated at operation. In the interlaminal space between the first sacral and the fifth lumbar is seen a nub of bone representing the anlage of the spinous process of the fifth lumbar. The right transverse process of the fifth lumbar is large but forms no pseudarthrosis with either the sacrum or ilium. Patient was entirely well 3 years after a spinal fusion of first sacral to fourth lumbar vertebra.

one may even be in the sagittal plane while the other is directly coronal (Fig. 1). As they vary in direction so they may also vary in size.

In 3,000 roentgenograms of the lumbosacral spine, Brailsford found that in 57 per cent the posterior articulations faced backward (coronal), 12 per cent inward (sagittal), and in 31 per cent they were grossly asymmetrical. Actually in specimens of the human skeleton and at lumbosacral fusion operations, one seldom finds absolute symmetry of the joints in either size or shape. Generally too the posterior articulations will be found transitional between the coronal and sagittal planes, and more often approach the former. To find a person suffering from low back pain in whom the posterior lumbosacral joints are symmetrical and exactly in the sagittal plane is so rare at this clinic as to excite much comment. If the posterior articulations are coronal but exactly similar, motion is free and smooth. However, its greater range puts more strain upon supporting ligaments and muscles. Where asymmetry exists the movement on one side must be eccentric to movement on the other, and trauma, with resulting synovitis and arthritis, can be easily induced. By irritation of the fifth lumbar nerve branches supplying the supporting ligaments and muscles of the joint and its capsule, and by reason of inflammation spreading to contents of adjacent intervertebral canal, pain radiates in fifth lumbar nerve distribution in back and lower extremity. As elsewhere in the body when joints are inflamed, muscles attempt to splint the joint by going into tonic spasm, thus causing more muscle fatigue and tenderness and completing the picture of lumbosacral strain.

Where the joints are asymmetrical, partial subluxation with locking is more likely to take place, accounting perhaps for some cases of sudden onset of low back pain accompanied by a definite snap, and for sudden relief from the same pain with a definite snap, either spontaneously or as the result of manipulation. Subluxations are sometimes seen at operation, especially when there has been some atrophy of the intervertebral disc.

Some degree of asymmetry of the posterior articulations is seen in most roentgenograms taken of the lumbosacral area in persons suffering low back pain. In 30 cadavers selected at random by von Lackum, none had exactly symmetrical lumbosacral joints, though 6 were nearly so. Eighteen were grossly asymmetrical and the 6 remaining more or less so. The constant trauma of eccentric motion may cause permanent osteoarthritis of the joints and chronic inflammatory changes in the structures contained in the adjacent intervertebral foramina. It has been noted in cadavers and at operations that when the lumbosacral joints are asymmetrical the joint closest to the coronal plane will have the more marked arthritic changes.

POSTERIOR DISPLACEMENT OF THE FIFTH LUMBAR VERTEBRA

Posterior displacement of the fifth lumbar vertebra (Fig. 2) was recognized as a developmental anomaly by Ferguson at the New York

Fig. 2. Posterior displacement of the fifth lumbar vertebra on the first sacrum, and an acute lumbosacral angle. Patient completely relieved of symptoms by a lumbosacral fusion. Follow-up period, 3 years.

Fig. 3. A transitional fifth lumbar vertebra.

Orthopædic Dispensary and Hospital in 1924. The patient (No. 71821) in whom this condition was first found had a lumbosacral fusion on May 28, 1924. Previously posterior displacement of the fifth lumbar vertebra had been noted in connection with fracture dislocation and also with tuberculosis of the vertebral body. However, it was not recorded in the literature from our institution until mentioned by Hibbs and Swift (1929) and Smith (1929). Similar observations were later published in American journals by Williams and Yglesias (1933), Ferguson (1934), Johnson (1934), and again by Smith (1934). Under the name of posterior spondylolisthesis it was described in European literature by Sicard, Haguenau, and Wallich (1928), Perrier (1929) and Junghanns (1930).

Posterior displacement of the fifth lumbar vertebra is commonly found in individuals having low back and sciatic pain. It was demonstrable in the roentgenograms of 235 (20.3 per cent) of 1,157 consecutive patients who were treated at this clinic for low back and sciatic pain. In nearly all these cases the posterior articulations were either in the coronal plane or nearly so. We believe it is one of the developmental anomalies most commonly associated with an unstable fifth lumbar vertebra. This condition has been called by Willis an optical illusion. However, we have roentgenographic evidence of posterior displacement as great as seven-sixteenths of an inch and must of necessity consider it real. A posterior displacement may be acquired in true atrophy of an intervertebral disc from any cause and in fracture dislocations of the vertebral bodies. These acquired displacements, when extreme, may cause direct pressure upon the lumbar nerves within the intervertebral foramina. If the intervertebral disc is normal there is no posterior displacement of the inferior articular processes of the fifth lumbar vertebra; conclusive evidence in support of the theory that the posterior displacement of the body is developmental. When there is true atrophy of the disc the posterior articulations are subluxated and marked osteoarthritic changes are found at operation.

Figs. 4, left, and 5. Prespondylolisthesis and an acute lumbosacral angle. A defect is plainly visible in the lamina of the fifth lumbar vertebra. At operation this defect was found to be filled with fibrous tissue. Note also how, due to the acute angle, the superior articular processes of the fifth lumbar project into the intervertebral foramina. Patient completely cured by a spinal fusion of the first sacral to the fourth lumbar. Follow-up period, 5 years.

TRANSITIONAL LUMBOSACRAL VERTEBRA

Mitchell states that "the normal formula for the human vertebral column is cervical, 7; thoracic, 12; lumbar, 5; sacral, 5; coccygeal, 4; but variations from this occur in about 20 per cent of skeletons." The number of cervical vertebræ is more constant but the thoracolumbar vary between 16 and 18, depending upon whether the tendency is to move the pelvis craniad or caudad. The greater tendency is toward decreasing the number of presacral vertebræ. Whether the number of vertebræ increases or decreases we call the one showing partial sacralization a transitional fifth lumbar vertebra.

Brailsford found the fifth lumbar vertebra to be transitional (Fig. 3) in 8.1 per cent of 3,000 spines examined by roentgenogram. These were routine roentgenograms and were not necessarily taken because of low back symptoms. The frequency with which this anomaly is found varies. It appears to be more common in primitive races. Mitchell quotes Wetzel as having found a transitional fifth lumbar vertebra in 18 per cent of Australian aboriginals. This condition was present in 125 (10.8 per cent) of 1,157 consecutive patients entering our clinic because of low back pain. Comparing this with Willis's 5.9 per cent in 1,471 routine skeleton examinations in a comparable racial group, it would appear that this anomaly makes for a lumbosacral junction of more than average vulnerability to strain. Mitchell is of the opinion that "in unilateral cases the impingement of the process on the sacrum or ilium may provide a fulcrum for the spinal column, which then acts as a lever of the second class tending to pry apart the lumbosacral transitional vertebra from the sacrum, straining or tearing the connecting ligaments. It is obvious that the ligaments on the opposite side to the sacralization will suffer most, which may account for pain often being on the side opposite the sacralization." In the 274 patients operated upon and discussed later in this article the writer could find no relationship between the side upon which, if present, sacralization occurred and pain radiation. Associated with this condition is a narrowing of the intervertebral disc proportionate to the limitation of motion due to the anomaly, sometimes a wedging of the vertebral body, small asymmetrical posterior articulations usually in the

Fig. 6. Spondylolisthesis in a 28 year old man. The defect in the lamina of the fifth lumbar vertebra is plainly visible. Patient complains of low back and sciatic pain of 8 months' duration.

Fig. 7. Spondylolisthesis. This anteroposterior view shows the shadow of the fifth lumbar vertebra superimposed on the shadow of the first sacral. A lateral view in the same patient showed the fifth lumbar vertebral body to have slipped completely off the first sacral. This condition was present in an 18 year old girl. Deformity had been noticed for 7 years and low back pain had been present for 2 years. A spinal fusion was done of the fourth lumbar to the first sacral. When last seen 6 years after operation the patient was employed as a cashier, her fusion mass appeared solid, and she was without symptoms. The deformity, of course, remained the same.

coronal plane or nearly so, and an early development of osteophytic lipping. Spina bifida occulta is common. Unilateral sacralization especially makes motion eccentric. The enlarged transverse process causes narrowing and lengthening of the lumen of the bony canal through which the anterior root of the fifth nerve must pass, increasing the possibilities of irritation.

EXAGGERATED LUMBOSACRAL ANGLE

The axis of weight-bearing of the body passes anterior to the lumbosacral juncture, causing a constant shearing strain which is proportional to the obliquity of the superior surface of the first sacral vertebra with the horizontal. This angle averages around 43 degrees, but may be much more and sometimes reaches nearly a right angle (Fig. 4). In these cases one often finds at operation a deepening of the posterior articular fossæ and the inferior articular facets of the fifth lumbar vertebra subluxated into them. An accentuated angle puts muscles and ligaments under great and constant strain; and by reason of the upward displacement of the posterior articular processes of the first sacrum toward the inferior intervertebral notches of the fifth lumbar vertebra the lumbosacral foramina are encroached upon (Fig. 4). This has been demonstrated on the cadaver by Danforth and Wilson and is seen in lateral roentgenograms. Likewise, a greater proportion of the superincumbent weight must be borne by the posterior spinal elements, ill prepared to receive it. There is an associated narrowing of the posterior portion of the intervertebral disc which, as mentioned by Ferguson, is not an atrophy but merely a

Fig. 8. A narrow intervertebral disc between the fifth lumbar and the first sacral vertebræ in a 54 year old female whose complaint was that of low back and bilateral sciatic pain of 5 years' duration. Note how small the lumbosacral intervertebral foramen is compared with those above.

phase in anteroposterior motion. This can be demonstrated by taking lateral roentgenograms in extreme flexion and in extension. Sometimes true atrophy of the disc is present.

In 28 European specimens, Mitchell found that the average inclination to the horizontal of the upper surface of the first sacral body was 41 degrees and the average inclination of the last lumbar vertebra in the same specimens was 19 degrees. This is one reason why fusing the fifth lumbar vertebra to the sacrum strengthens the spine and lessens muscular and ligamentous strain.

SPONDYLOLISTHESIS

Spondylolisthesis was described by Herbineau in 1782. The term, derived from the Greek meaning "gliding of a vertebra," was first used by Killian in 1852. In 1892, Neugebauer collected 101 specimens showing the deformity. He ascribed the condition to lack of fusion between two centers of ossification existing in each lateral half of the neural arch. It most commonly affects the fifth lumbar (Figs. 6 and 7). Between 1914 and August 1936, 104 patients had a spinal fusion at the New York Orthopædic Dispensary and Hospital because of low back pain resulting from this condition. We have found in all these a failure of fusion in the lamina between the superior and inferior articular processes, usually bilateral. The osseous portions are connected by fibrous tissue. This has, of course, been repeatedly seen and reported on museum specimens and cadavers and its congenital nature cannot be doubted. As has been pointed out by Willis, no callous formation is seen, which precludes fracture. We have one patient of whom roentgenograms taken in early childhood revealed a defect in ossification of the lamina of the fifth lumbar vertebra without slipping (prespondylolisthesis), and another series of roentgenograms of the same patient taken several years later showing a marked anterior displacement of the vertebral body. Anterior slipping probably is more often due to gradual stretching of the fibrous defect in the lamina rather than sudden rupture.

Sixty-two patients having spondylolisthesis and one having prespondylolisthesis (Figs. 4 and 5) were found among the 800 treated for low back pain in this clinic during 1934. This represents new patients received during the year and "hold-overs" from preceding years. However, in 1,157 consecutive new patients entering the clinic with low back and sciatic pain, 3 had prespondylolisthesis and 44 spondylolisthesis, a combined percentage of 4.1. Willis reported congenital defects in the neural arches in 4.28 per cent of 748 skeletons in a comparable racial group. It is surprising to see that the apparent combined percentage of prespondylolisthesis and spondylolisthesis in individuals having low back pain is no higher than the average incidence for this congenital defect. On a few occasions we have found at operation a fibrous defect in the lamina between the superior and inferior articular processes that had not been observed in roentgenograms of that area. This failure to detect by roentgenogram all cases of this defect may account for its apparently low incidence in patients having low back pain.

As demonstrated in the dissecting room and at operation, the posterior elements of the defective vertebra are underdeveloped,

hypermobile, and the attached ligaments attenuated so that they are poorly prepared for the mechanical disadvantages associated with anterior displacement of the vertebral body. An exaggerated lumbosacral angle and spina bifida occulta are commonly found with spondylolisthesis.

DEGENERATIVE CHANGES IN THE LUMBAR SPINE

The spine is one of the first organs of the body to show the degenerative changes of increasing tissue age. These changes are most manifest in the lumbar spine, particularly at its junction with the sacrum, and it is here, for reasons already stated, that anatomical changes are most likely to cause symptoms. Lessened elasticity is one of the earliest degenerative changes coming in the normal life history of the intervertebral disc. This magnifies the mechanical shocks to which the bony surfaces are exposed.

In 3,000 routine examinations of the spine at autopsy, Schmorl found fissuring of the cartilaginous plates allowing herniation of the nucleus pulposus into the spongiosa in 38 per cent. This, of course, narrows the intervertebral discs (Fig. 8) in addition to decreasing their shock-absorbing power. The narrowed discs disturb the relationship of the articular surfaces of the posterior joints, and osteoarthritis results.

Beadle writes that herniation of the disc substance posteriorly into the spinal canal was found in 15.2 per cent of 368 spines. None was seen under 30 years of age, and most were in individuals over 50. He does not mention what percentage of these occurred in the lower lumbar spine.

That such a condition could cause sciatica and low back pain was first mentioned in this country by Goldthwait in 1911, and almost simultaneously by Middleton and Teacher in Scotland. Their work has lately received ample confirmation by Mixter and his coworkers, who have reported operating upon 23 patients in whom a herniation of disc substance posteriorly had been accompanied by sciatica and low back pain. All but one obtained immediate and complete relief from sciatica when the offending herniation was removed. The follow-up period has been too short to testify as to the permanency of the relief. The age, history, and physical findings differed in no way from what one commonly finds in patients having a severe so called lumbosacral strain or unstable fifth lumbar vertebra. All, however, had an elevation of spinal fluid protein and most a definite shadow defect after injection of lipiodol into the subarachnoid space. There have been more recent reports of intervertebral disc herniations unaccompanied by an elevation of spinal fluid protein, but an elevation is much the more common finding, being present in 36 of 39 recently reported cases (Hampton and Robinson). The only other significant roentgenographic finding was a thinning of the intervertebral disc at the level of the lesion in 5 of the 23 patients. At operation the disc protrusion was found between fourth and fifth lumbar, 15 times; fifth lumbar and first sacral, 5 times; third and fourth lumbar, twice; and first and second sacral, once. Posterior herniations of the disc between the fourth and fifth lumbar usually press directly upon the fifth lumbar nerve root. This lesion is not uncommon, for in 18 months 12 cases were seen and patients were operated upon at the Massachusetts General Hospital.

DIAGNOSTIC SPINAL PUNCTURE IN LOW BACK PAIN

It was with the work of Mixter and his colleagues in mind, and with the hope that more light would be thrown upon the etiology of sciatica and low back pain, that now all patients entering the New York Orthopædic Hospital for operative work because of this condition have a spinal fluid examination. Particular attention is paid to the protein content. In 12 of the first 50 patients it was found to be above the commonly given upper limit of 42 milligrams per 100 cubic centimeters for the method used. In one the reading was 100 milligrams per cubic centimeter and the globulin was 2 plus. This turned out to be due to a cord tumor and will be discussed later. In 11 the protein varied from 43 to 64 milligrams and averaged 50. The spinal punctures were done between the third and fourth lumbars. In Mixter's cases, with proved disc pro-

trusions in the lumbosacral area, the readings above the level of the lesion varied from 56 to 91 milligrams.

Of these 11 patients 1 had a thin disc between first sacral and fifth lumbar, 2 a thin disc between fourth and fifth lumbar, and 2 had arthritic lipping of the lumbar spine. All had what we considered an unstable fifth lumbar vertebra.

Five of these patients had tensor fasciæ latæ fasciotomies only, 3 spinal fusions between the first sacral and fifth lumbar or first sacral and fourth lumbar, and 3 both procedures. All were completely relieved of their symptoms.

What are we to conclude from this? (1) Can inflammation of the nerve roots cause an elevation of the spinal fluid protein to the figure given? (2) Does elimination of motion take away the harmful effects of a protruding disc—can a fasciotomy break the mechanism by which it lets its presence be known?

The information from this group of spinal punctures is incomplete as neither lipiodol injections nor laminectomies were done; but does add a few facts to the store of knowledge from which we can make our own postulates.

In answer to these questions it may be stated: (1) It is my belief that in sciatica associated with an unstable fifth lumbar vertebra there are inflammatory changes in the fifth lumbar and occasionally adjacent nerves, secondary to similar changes in surrounding tissues. Since statistics upon this group were compiled we have had one case which offers much to support this contention.

The patient, a young man, had a combined laminectomy and spinal fusion, first sacral to fourth lumbar, done for a pre-operative diagnosis of posterior herniation of the lumbosacral disc. His spinal fluid protein was 93 milligrams. The intervertebral disc, between first sacral and fifth lumbar, was thin and much osteo-arthritis existed in the posterior articulations. Bilateral absence of the Achilles reflex, fibrillary twitchings in the buttocks, hyperesthesia on the dorsum of the right foot, and muscular atrophy of the right lower extremity existed. There was a clinical history typical of an unstable fifth lumbar vertebra. At operation no disc herniation was found, but the veins accompanying the fifth lumbar nerves were varicosed, and with them completely filled the intervertebral foramina. Motion in the posterior articulations was seen to cause direct pressure on veins and nerves. The dura mater was gray and tough. The nerves forming the cauda equina at this level had a fine capillary injection and those nearest the periphery were slightly adherent through the arachnoid to the dura. These changes, it seemed, were secondary to the surrounding osteo-arthritis. In spite of them the patient had obtained some relief from a supporting belt. It is too soon after operation to determine the effect of spinal fusion.

It is a common experience to find in patients having severe sciatica that pressing upon the jugular veins to increase spinal fluid pressure, while keeping the spine as immobile as possible, will produce definite pain in the sciatic distribution. This is often true in patients later cured by a spinal fusion. Inflammation would be a logical explanation for this lowered threshold, and I believe it is sufficient to account for the slight elevations in protein we have recorded. The cross reflex phenomenon seen in severe unilateral sciatica requires a lowered threshold to stimuli on the involved side and may be accounted for by inflammation of the nerve on that side. Here straight leg-raising of the opposite extremity causes pain to radiate down the limb having sciatica.

(2) We know that following compression fractures of the vertebral bodies, or collapse and destruction of bodies in tuberculosis, spinal root pains may be experienced. Elimination of motion in the involved area will cause these pains to disappear as soon as the fusion is solid. If the syndrome we are discussing is caused by a disc protrusion as often as some reports would have us believe then many of the spinal fusions listed below must have been done in such patients. Yet in the list of failures there is no large group the cause of whose failure cannot be accounted for. It seems reasonable to assume that the ill effects of a protruding disc can be eliminated by removing motion. If so, a spinal fusion would be more logical than a laminectomy, which leaves a mechanically weak spine. If an attempt is made to combine the two operations it is difficult to escape a pseudarthrosis. Since routine spinal autopsies have shown posterior disc protrusions to be so common in adults over 30 years of age many of them must cause no symptoms whatever. Protrusion of the disc is not alone sufficient to prove that it is all, or even part, of the causative factor in producing symptoms.

The twelfth patient having an elevation of spinal fluid protein (100 milligrams) had an epidermoid tumor in the lumbosacral portion of the spinal canal. Removal of the tumor brought complete riddance from symptoms. This patient had a typical history and physical findings of lumbosacral strain and had been diagnosed and treated as such for 4 years in 5 metropolitan institutions, including our own. Only the spinal fluid findings and later lipiodol injection enabled us to make the correct diagnosis. This 1 case in 50 is in itself sufficient reason for doing spinal punctures, at least on those patients on whom operative work is contemplated.

AN EXPLANATION OF SCIATIC AND POSTERIOR SACRAL PLEXUS PAIN

Pitkin and Pheasant have attempted to explain sciatica largely on the basis of referred pain from the sacro-iliac or lumbosacral joints and their supporting ligaments. This requires considerable ingenuity as the pain may invade areas corresponding to the skin dermatomes of the twelfth thoracic, all 5 lumbar, and the first 3 sacral nerves.

Referred pain is commonly defined as a projected pain which proceeds from an irritated nerve centrally to the central nervous system, then out along branches of that or other nerves arising from the same or adjacent spinal segments to their skin dermatomes. That sciatica is in part a referred pain is evident in that pressure over the ligaments on the posterior aspect of the sacro-iliac joint in which ramify the branches of the posterior sacral plexus will cause a relatively superficial burning pain on the lateral aspect of the leg (fifth lumbar dermatome). For example, a patient in our wards had a hip spica applied following a hip fusion. Upon awakening he complained bitterly of pain in his right leg; a pain he had never experienced before. Morphine provided but little relief. It was not until the next day that pressure on the posterior aspect of the right sacro-iliac joint region was noticed. When this pressure was removed the pain in his leg immediately disappeared. It has not returned.

I think medical men who have had sciatica and posterior sacral plexus pain themselves will agree that the pain is generally deep, centers over the posterior aspect of the sacro-iliac joint, radiates out into the buttocks, follows the course of the sciatic nerve from the sacro-sciatic notch to the popliteal space, then in the leg the course of the peroneal nerves. From these centers it spreads in a diffuse and ill-defined way to the posterior and posterolateral aspects of thigh and leg, with occasional radiations to the sole and dorsum of the foot. The greater the pain the more diffuse and extensive are its radiations. When severe there is a constant dull ache and tenderness along the course of the sciatic nerve and its branches and over the posterior sacral plexus and its branches. Superimposed upon this are stabbing pains brought on by unguarded motion in the lumbosacral spine or a sudden change in spinal fluid pressure. At times one may feel the intensity of the pain rise and fall with respiration even though one lies as motionless as possible on a firm flat surface. The pain feels most superficial on the lateral aspect of the leg, an area corresponding to the cutaneous distribution of the fifth lumbar nerve (Head). It is in this area too that one most often finds hyperesthesia or hypesthesia if any sensory changes are present. The site of most intense pain is likely to vary from day to day with the favored spots in order of frequency being the posterior aspect of the sacro-iliac joint, posterolateral aspect of the leg, the popliteal space and the posterolateral aspect of the thigh.

The Achilles reflex (fifth lumbar, first and second sacral) is often diminished or absent The sciatic nerve, posterior sacral plexus and structures supplied by them are tender. Partial or complete paralysis of the muscles supplied by the peroneal nerves (fourth and fifth lumbar and first sacral) may exist. All these signs have been seen to disappear following a fusion of the spine from first sacral to fifth lumbar.

Referred pain does not readily explain nerve tenderness, sensory, motor and reflex changes for these are probably signs of actual nerve pathology. Nor does it explain the deep, diffuse pain centering along the course of the sciatic nerve which in no way follows dermatome patterns commonly mapped out

by anatomists for the buttocks and lower extremities.

It has been established that motor nerves can possess protopathic sensations so that stimulation of such a nerve causes a definite, diffuse, and ill defined pain. A simple adequate explanation for that major portion of sciatica and its accompanying phenomena not explainable on a referred basis is that irritation of the fifth lumbar nerve in its intervertebral foramen, or in the spinal canal, causes a neuritis, lowers its threshold to stimuli, and sends protopathic sensations out along its motor branches. Sensory branches within the nerve which go to the lateral aspect of the leg are also stimulated, accounting for the more superficial nature of the pain and the occasional sensory changes in that area. If stimuli are strong enough they may spill over into the other branches of the sciatic nerve, resulting in such a phenomenon as pain in the lateral plantar aspect of the foot.

After leaving the intervertebral foramen the posterior division of the fifth lumbar nerve turns backward and divides into branches which supply the lumbosacral articulations, supporting ligaments and muscles, and enter into the posterior sacral plexus along with the sacral nerves. While in the intervertebral foramen it is subject to the same irritation as the anterior division which forms part of the sciatic nerve. Another source of irritation is the lumbosacral joints and their supporting muscles and ligaments. That these things may be so is suggested by the disappearance of pain in this area on fusion of the fifth lumbar vertebra to the sacrum. Pull of a spastic gluteus maximus upon its origin from the posterior sacro-iliac and sacrotuberous ligaments, supplied by the posterior sacral plexus, may be a third source of pain. This is demonstrated by the sudden relief from this as well as sciatic pain which may follow a posterior Smith-Petersen incision (Heyman).

DIAGNOSIS

The symptom-complex often designated as "low back trouble" occurs most commonly between the years 20 and 50. In 600 consecutive patients entering our dispensary with this complaint the average age of the females was 35 and of males 37. Most of these patients had had symptoms for several years. Among females many dated their trouble as coming on during pregnancy or following childbirth. Both sexes were wont to have their initial symptoms in that decade between 25 and 35 years when muscles begin to lose their tone, yet the individual fails to appreciate that he can no longer go suddenly from his now more sedentary ways into strenuous physical efforts without suffering the consequences. Others may not develop symptoms until about the fifth decade of life when degenerative changes such as osteo-arthritis so often become clinically noticeable. In this group of 600, 42 were less than 20 years of age and only 18 over 60. A disproportionate number of the former had spondylolisthesis, a condition which may produce a noticeable deformity sufficient to cause the patient to seek medical counsel even before symptoms appear. Females slightly outnumbered males in this group; most writers, however, report more males than females.

A single definite traumatic accident may initiate symptoms, but more often the onset is insidious with exacerbations following severe or sudden back strain. First symptoms are usually muscle fatigue and an ache in the low back area radiating out over the sacro-iliac joints and into the buttocks. Back stiffness is a morning complaint, and low back pain is experienced on sudden unguarded movements or spinal movements of considerable range. Lifting, coughing, and straining are painful. In many backache is accentuated by the presence of a focus of infection elsewhere in the body and in some by damp weather. Menstruation in women and chronic inflammatory conditions in the pelvic region may increase the pain. The patient feels best when lying on a firm, unsagging surface. Sciatica may not be present at the onset. Occasionally, however, it is the only symptom and it is the common finding in severe and chronic cases. A lateral list of the trunk (sciatic scoliosis), either contralateral or ipsolateral, may be present. The former is twice as common as the latter. A description of the symptoms and signs in the lower extremity has already been given. Pain in the lower extremity may be accompanied by a con-

tracted tensor fasciæ latæ sufficient to cause an abduction deformity of the hip.

This syndrome is found in both active and sedentary people and in all types of body build, but is more common in those of herbivorous build, probably because they are more subject to lumbosacral anomalies and degenerative changes in the spine.

Poor posture is a common finding, especially when the patient is of the slender type. Lumbar lordosis is variable, being entirely eliminated in some acutely painful backs, whereas more chronic cases may show increased lordosis. Motion of the lumbar spine is limited, as a rule, by pain and muscle spasm. Tenderness may be present in the iliosacral-lumbar angle, over the fifth lumbar spine, and most commonly in that area under which lies the origin of the gluteus maximus muscle, the posterior sacro-iliac ligaments, the joint itself and the posterior sacral nerve plexus.

Tests that produce motion in the lumbosacral joints cause pain as a rule. Lasègue's sign stretches the sciatic nerve. The only so called sacro-iliac tests which do not move the lumbosacral joints too are springing of the joints by compression of the iliac wings, and pressure over the symphysis pubis.

DIFFERENTIAL DIAGNOSIS

Primary myofascitis. Probably prolonged irritation of the sciatic nerve will produce a myofascitis in the muscles supplied by it. Certainly tenderness on squeezing the calf muscles is a common finding in individuals having sciatica but no apparent focus of infection or an arthritic diathesis.

However, one often finds a patient who was symptom free until he developed an acute infection such as tonsillitis. He then had back pain and sciatica, accompanied by fascial and muscle tenderness in back, buttock, and thighs, which cleared up shortly after elimination of the acute focal infection. Here is a case of toxins making their presence known at the point of least resistance. Such a patient may have an unstable lumbosacral mechanism whose reserve margin has been broken down by the addition of a toxic load. It is more helpful to think of the latter group as cases of primary myofascitis and concentrate one's efforts on the elimination of the infectious process.

Fascial planes may be likened to joints allowing muscles to glide. If actual inflammation exists between these surfaces adhesions form causing pulling upon nerves which pass through the fascia into the muscle. Hence a chronic myofascitis quite resistant to treatment may develop. Patients so afflicted are poor subjects for spinal fusion even though their condition is aggravated by an unstable fifth lumbar vertebra.

Spondylitis ankylopoietica (Marie-Strumpell type). This is a disease which in its early stages consists of an inflammation of the posterior articulations and ligaments of the spine. Later they undergo ossification. Golding has well shown that even before there is roentgenographic evidence of involvement of the vertebræ such evidence is present in the sacro-iliac joints. Two of the 681 patients upon whom spinal fusions were done for an unstable fifth lumbar vertebra at the New York Orthopædic Dispensary and Hospital later went on to develop this type of spondylitis. At the time of fusion they were young adult males with history and physical findings typical of that commonly associated with an unstable fifth lumbar vertebra. Examination of the pre-operative roentgenograms did, however, show arthritic condensation of the sacro-iliac joints and a slight furring of the lumbosacral joints. The above story, plus a history of transient synovitis of some of the joints of the extremities several years previously, are the common early findings. Later in its development this disease presents a typical picture easy to diagnose correctly.

Osteo-arthritis. As previously stated, this condition is one of the causes of low back and sciatic pain. When localized to the lumbosacral area the treatment differs in no way from that to be outlined. If generalized osteoarthritis of the spine exists, treatment, particularly operative, must undergo drastic modification. Roentgenograms and the presence of generalized back pain make diagnosis of this condition simple.

Sacro-iliac strain. As early as 1863 Hilton wrote that sciatica might be caused by sacro-iliac or lumbosacral disease and that differen-

tiation of the two conditions was almost impossible. He described typical cases of low back and sciatic pain which he attributed to disease in the sacro-iliac joint. He treated them by rest much as it is done today.

In 1905 Goldthwait and Osgood stated that this syndrome might be due to sacro-iliac relaxation, subluxation, or arthritis. This conception of the etiology became extremely popular and still has its adherents. Some feel that sciatica is referred pain from the ligaments of the sacro-iliac joint, others that the fourth and fifth lumbar nerve trunks are irritated as they lie in close proximity to the anterior aspect of the joint. Earlier in the paper reasons for believing that sciatica is only in small part, if at all, a referred pain are given. We have case records in which a large abscess forming over the anterior aspect of the sacro-iliac joint, secondary to tuberculosis or osteomyelitis within has caused sciatica. However, even assuming that a minute subluxation of the sacro-iliac joint takes place, it is difficult to believe it would irritate the lumbosacral cord, which is held loosely attached to the anterior aspect of the sacral body with its fourth lumbar root, and occasionally the fifth lumbar, lying over only the inferior angle of the joint (Danforth and Wilson).

The sacro-iliac joints allow but a few degrees of rotary and sliding motion and have the strongest ligamentous support of any joints in the body. They are made for stability, not mobility. It is hard to conceive of low back pain being the result of ligamentous strains or minute subluxations at this joint. Such a conception is particularly difficult to entertain when one sees tuberculosis, chronic arthritis, or gross subluxation of a sacro-iliac joint following severe injury unassociated with a great deal of pain. It is surprising that the symptom-complex just discussed should be attributed to strain of these joints when in their immediate vicinity a mechanical set-up exists which theoretically can readily account for the symptoms produced. Probably because non-operative treatment devised for sacro-iliac strain is of equal therapeutic value for lumbosacral strain, and the various diagnostic tests aimed at eliciting symptoms in one are almost as effective in producing symptoms in the other, the misconception has been long lived.

In operative fusion of the sacro-iliac joint the posterior attachments of the gluteus maximus and deep fascia are usually widely stripped from the posterior iliac crests. Heyman has found that this procedure alone will sometimes give a complete cure from sciatica. Bed rest, immobilization and physiotherapy, which accompany operative treatment, have also proved beneficial in low back pain, hence the fallacy of sacro-iliac strain has not been as quickly exposed as it might have been. The writer does not consider pain to be of sacro-iliac origin unless there is evidence of disease or gross displacement of that joint. The depth, obliquity, irregularity of joint surfaces, and overlying shadows make any roentgenographic interpretations difficult and subject to a large margin of error.

Coccygodynia. Falls that injure the coccyx may cause lumbosacral injuries also. Perhaps because of this many have felt that pain due to an unstable fifth lumbar vertebra may be referred to the coccyx. This has been disproved as a result of the careful studies of Duncan. On several occasions lumbosacral fusions have been done at this hospital for a combination of symptoms from these two conditions. The low back and sciatic pain has disappeared but the coccygodynia has remained until finally cured by coccygectomy.

Coccygodynia is usually accompanied by a definite history of direct trauma to the coccyx. Males are seldom afflicted as their narrow sacrosciatic notches permit the coccyx to be tucked in between the ischial tuberosities, and to be protected from falls in a sitting position. Pain is worse when sitting or on rising from a sitting posture. It is lessened by sitting on an air-cushion ring or contracting the glutei while sitting erect, thus raising the coccyx off the chair. External and rectal palpation will reveal tenderness, and there may also be increased mobility and angulation of the coccyx on the sacrum. When arthritis is present at the sacrococcygeal joint minor traumas often cause coccygodynia. Roentgenograms may show an unusually long or unprotected coccyx, osteo-arthritis, acute angulation and, more

rarely, a fracture dislocation. Variation in the number of coccygeal vertebræ, and a transitional first coccygeal vertebra are common.

Fractures of the spine. Compression fractures of the vertebral bodies and fractures of the transverse processes or posterior elements of the spine occasionally produce a syndrome resembling that of lumbosacral strain. Roentgenograms and history should enable one to differentiate the two.

Spinal cord tumors. Spinal cord or cauda equina tumors are the most difficult problem in the differential diagnosis of low back pain. If the patient's pain is greatest when recumbent, even if on a firm unsagging surface, is particularly accentuated by coughing or pressure upon the internal jugular veins, and both sensory and motor disturbances are present, cord tumor must be suspected. If a tumor is present there will be an increase in spinal fluid protein, a complete or partial block, and a defect in the lipiodol shadow.

While low back pain in the majority of patients is satisfactorily explained by the mechanical and degenerative changes just discussed, it must be remembered that a similar syndrome can be produced by infectious diseases and new-growths involving the lumbosacral area of the vertebral column. Symptoms in these cases are caused by inflammation and toxic absorption as well as the mechanical disturbance produced. Tuberculosis, chronic osteomyelitis, and metastatic tumors particularly must be kept in mind. These should not be difficult to rule out if the examination has been thorough and roentgenograms taken.

Prostatitis and vesiculitis in the male; malposition, new-growths, and inflammatory conditions in the pelvic organs of the female; and rectal pathology in both sexes must be considered. A differential diagnosis of these conditions is not within the scope of this paper. I do not believe that the picture of low back pain and sciatica is commonly caused by intrapelvic pathology.

NON-OPERATIVE TREATMENT

A. Mild cases. Exercises designed to improve body posture and to strengthen the muscles of the lumbar spine and abdomen are beneficial. Exercises should not be carried to the point where strain and its accompanying symptoms are produced, and for this reason they are impractical while symptoms are severe. Patients are to be cautioned against activities that cause back pain. Women addicted to high heels should replace them with low heeled shoes because of the adverse action of the former on general body posture.

Heat followed by massage is helpful. For economic reasons it is well to instruct the patient and some other member of the family in the manner this should be carried out so that they may do it at home daily.

Elimination of bed sag by placing a fracture board between the mattress and bed springs is of great value and, next to postural exercises, gives more relief than any measure to be considered when symptoms are mild.

Foci of infection in all cases should be searched for and, if possible, eliminated.

B. Cases of moderate severity. These patients should, in addition to the above treatment, be given a supporting belt, corset, or brace. It is to be noted that while providing much relief from back pain, external supports seldom lessen sciatica to as great a degree. In women a stiff corset containing little or no elastic, to which has been attached a back pad to fit into the "small" of the back, is satisfactory. Men may be supplied with a lumbosacral belt having a similar back pad. The belt should be 6 or 7 inches wide for an adult and have perineal straps.

For patients having considerable pain or an accompanying generalized spinal arthritis, a light Taylor back brace gives more support. If arthritis is confined to the lumbar spine a brace about 11 inches in height is sufficient, but if the dorsal spine is also involved it should extend from the buttocks to the first dorsal vertebra.

External supports should be discarded gradually when severe symptoms disappear, for if prolonged they weaken the very muscles that support the lumbar spine.

C. Severe cases. If the onset of pain is acute, recumbency on a firm bed, with a brace such as described applied to the back, and, if sciatica is present, adhesive moleskin traction to the legs, is indicated. Daily baking and

light massage should be given. Sedatives are sometimes required.

Much the same treatment is applicable to chronic cases if operative work is contraindicated or refused.

Prolonged suffering which has failed to respond to treatment leads, in many patients, to the development of anxiety tension syndromes and neuroses. For such, a full explanation of their condition plus positive assurance that they can be made well, when combined with effective treatment, is helpful. Symptoms are likely to be exaggerated and convalescence prolonged in patients receiving compensation. This is particularly true in the older and the less ambitious, and must be considered in any plan of treatment.

Epidural injections. We have not found epidural injections of novocain of sufficient value to warrant their continued use.

Manipulations. Forceful manipulations often harm and are never warranted. Manipulations may be used routinely when gently done. One seldom sees a dramatic cure but often the patient's suffering is temporarily allayed. It is probable that some who are given relief have had a subluxation of one or both posterior articulations which have slipped back in place during the maneuvers.

OPERATIVE TREATMENT

Tensor fasciæ latæ fasciotomy. In 1920 Percy W. Roberts, of New York, found that sciatica could be relieved by releasing the tensor fasciæ latæ, gluteus medius, and the anterior portion of the gluteus maximus from their origins and allowing them to slide down and re-attach at a lower level on the ilium. He did not publish his results. In February, 1934, Ober cut the fascia tensor over and adjacent to the tensor fasciæ latæ muscle and found it relieved the patient of low back and sciatic pain in a fair percentage of cases having what he considered a contracted fascia. The test devised by Ober to detect contracture of the iliotibial band and fascia lata, and his operation for correction of the condition, are described in articles by him (24, 25).

Our incomplete knowledge makes it difficult to say what is or what is not normal fascia in the living adult. Certainly it varies a great deal in thickness and tautness from individual to individual. Likewise, the number and size of intermuscular fibrous bands extending from the fascia is variable. Generally the fascia is most taut and thick over the anterior portion of the tensor fasciæ latæ. After severance the cut edges of the fascia spread from 1 to 2 inches. In our cases the fascia when examined microscopically has appeared normal.

No satisfactory explanation has been given as to why a fasciotomy sometimes brings relief from sciatica and low back pain. We know that many patients have had partial relief from a fasciotomy and then complete relief on doing a lumbosacral fusion; the reverse is also true. Lumbosacral fusion cures completely and permanently a much higher percentage than does fasciotomy. However, there are cases such as this: A 24 year old man entered our hospital with an extremely painful low back and left-sided sciatica and an ipsolateral list of the trunk. Roentgenograms showed a posterior displacement of the fifth lumbar vertebra. A lumbosacral fusion gave complete relief and he returned to his work as a house painter 4 months after operation. Three years later he had a sudden onset of right sciatica and low back pain and again an ipsolateral list of the trunk. Non-operative measures pursued for several weeks did not help at all. A right fasciotomy was then done, relief was immediate, and the patient was still symptom free 11 months after operation. There are no clear cut signs which tell us that this patient's symptoms are due to a tight fascia and will be relieved by a fasciotomy or that another patient's symptoms are due to an unstable fifth lumbar vertebra and will be cleared up by a lumbosacral fusion. The Ober test is often positive in individuals who have never had sciatica and is particularly likely to be so in people of herbivorous build of middle age or beyond. It may be positive after a spinal fusion that has cured the patient completely, and may remain positive even after a fasciotomy that has had the same happy ending. When sciatica is unilateral it is, however, usually more positive on the involved side. The writer has seen patients with sciatica and a strongly positive Ober sign both of which have disappeared completely in

the course of 1 or 2 weeks of non-operative treatment. Releasing the gluteus maximus from its attachments to the posterior aspect of the sacro-iliac joint and iliac crest will free one of sciatica much as a fasciotomy does. Signs such as an absent Achilles reflex, positive Lasègue's test, tenderness and muscle atrophy may disappear, as well as symptoms, following a fasciotomy.

From these facts one can assume that the Ober sign is not necessarily positive because of a tight fascia but may be due to muscle spasm. Certainly fascia is not tissue that can contract in a few days, then return to normal in a few more days, and that is the supposition one would have to make in ascribing to it the Ober sign. When muscle spasm and therefore shortening has existed for a long period of time and has been accompanied by inflammation, one can conceive of fascia undergoing actual contracture. Since inability to adduct the thigh, and a fascia that feels definitely tight may be present even when sciatica is not, one cannot place a great deal of reliance in the Ober test.

A fasciotomy lessens the tension of the gluteus maximus and fascial covering by allowing origin and insertion to follow more nearly a straight line course. One can conceive of this affecting sciatica and low back pain in three ways, and perhaps all three play some part in the picture: (1) strain upon the lumbar spine becomes less; (2) tension exerted upon the origins of the gluteus maximus and fascia lata is decreased; (3) any pressure which a spastic gluteus maximus muscle might impose on the underlying sciatic nerve is lessened. Whether this is the manner in which a fasciotomy interrupts the mechanism by which pain is produced is conjectural. However, I believe that one must still look to the lumbosacral spine to find the primary etiological factor in this syndrome.

Up to September 1, 1936, this operation had been done upon 79 patients at the New York Orthopædic Dispensary and Hospital. In 9 the fasciotomy was bilateral, and in 2 it was repeated because of failure to obtain relief at the first operation. These patients varied in age from 14 to 80 years. Forty were females, averaging 36, and 39 were males averaging 39 years of age.

TABLE I.—TYPE OF LIST AND RESULT OF OPERATION

	Direction of trunk list				
	Ipso-lateral	Con-tra-lateral	Alter-nating	Total	Per cent
Complete or more than 90 per cent relief	2	4	2	8	38
75 per cent relief	0	4	0	4	19
50 per cent relief	3	0	0	3	14
Less than 25 per cent or no relief	1	5	0	6	29
Total number of patients	6	13	2	21	

All of the patients had severe sciatica which had not proven amenable to non-operative treatment. In 34 the sciatica was on the right side only at the time of operation, in 30 on the left, and in 15 it was bilateral. However, in the latter pain was usually much worse on one side than the other. The length of time symptoms had been present varied from 4 weeks to 23 years and averaged 4½ years. Fifty-seven of the 79 patients had fatigue or fatigue and pain across the back at and above the level of the lumbosacral junction in addition to sciatica.

Twenty-one (27 per cent) of the patients had a definite list of the trunk, so called sciatic scoliosis. The type of list and the operative results in this group are shown in Table I.

A comparison of these results with those listed in groups I and II below shows no significant difference in the results obtained. Theoretically this might seem a favorable group, as in them the Ober test is more likely to be strongly positive.

Excluding all patients who had not been followed for more than 2 months, the remainder were divided into 3 groups.

Group I. These patients had only a fasciotomy. The average follow-up period was 8 months. In this as in the other groups, when relief was obtained it sometimes came with dramatic suddenness, but more often while considerable immediate diminution in pain was obtained several weeks elapsed before it was completely gone. Sciatica usually disappeared before back pain. Occasionally

TABLE II.—INVOLVEMENT AND RESULTS

	Sciatica ony		Sciatica and back pain	
	No.	Per cent	No.	Per cent
Complete or more than 90 per cent relief	6	67	7	33
Complete relief from sciatica but still some back pain	0	0	5	24
50 to 75 per cent relief	1	11	6	29
Less than 25 per cent or no relief	2	22	3	14
Total number of patients	9		21	

TABLE III.—RESULTS IN GROUP II

	Unilateral No.	Bilateral No.	Total	Per cent
Complete or more than 90 per cent relief	4	1	5	25
50 to 75 per cent relief	7	1*	8	40
Less than 25 per cent or no relief	4	3	7	35
Total number of patients	15	5	20	

*This patient had a bilateral fasciotomy with complete relief on one side, none on the other. The latter was repeated four months later with a repetition of the failure. She has a definite pseudarthrosis in her spine fusion.

the former would disappear completely and the latter remain. More commonly both were lessened, but the disappearance of back pain would be less complete and would take longer.

Analyzed in another way, in the entire group 13 (43 per cent) were well, 12 (40 per cent) had at least 50 per cent relief from symptoms, and 5 (17 per cent) were not materially improved (Table II). These results are quite similar to those of Ober, who in 42 patients reports 23 (55 per cent) as well, 10 (24 per cent) as improved, and 9 (21 per cent) as unimproved. However, our results are not as sanguine as this group might indicate, for in the analysis one must consider at least the 5 patients in group III in whom a period of 1 month elapsed before the spinal fusion.

Of special interest in this group is one patient who had a fasciotomy on one side with complete relief, but 1 year later returned with sciatica on the opposite side. This, too, was completely cleared up by a fasciotomy.

Several of the failures in this and the other groups had some relief immediately after the operation, but symptoms returned as soon as they again became active.

Group II. There were 20 patients who previously had had a spinal fusion, and in one case a sacro-iliac fusion too, for relief from sciatica and back pain. In some the fusion had been done several years previously but more often but a few months had elapsed. In all of the cases shown in Table III, however, at least 2 months elapsed between the spinal fusion and fasciotomy. The average follow-up period since fasciotomy was 11 months. In the majority of this group the remaining symptom after fusion was sciatica only.

Of the 7 failures, one did have complete relief for 6 months, then a recurrence. His fusion has been explored and found solid. A complete sectioning of the piriformis muscle has also failed to bring relief from pain (Frieburg). In another patient symptoms returned suddenly after an absence of 16 months. Two had pseudarthroses repaired later and have obtained complete riddance of pain. One other has a definite pseudarthrosis clinically and by roentgenogram but has refused an attempt at repair.

Group III. In this group the fasciotomy was accompanied or followed by a spinal fusion. In 3, the operations were simultaneous and, while all are well, one can draw no conclusion as to which procedure had the curative effect. The others are tabulated in Table IV.

Six of the above 9 patients have been seen at least 5 months after spinal fusion (first sacral to fifth lumbar). Four are symptom free while 2 have had no appreciable relief. One of the latter has recently had a pseudarthrosis repaired.

Lumbosacral anomalies present in this series of patients were essentially the same as those in which we have performed spinal

TABLE IV.—RESULT FROM FASCIOTOMY, GROUP III.

	Spinal fusion within one month after fasciotomy	Spinal fusion 1 to 13 months after fasciotomy. Average period 5 months
Relief from sciatica but not back pain	1	1
Partial relief from sciatica, none from back pain	1	2
No relief	2	2
Total number of patients	4	5

fusions except that none had spondylolisthesis. The lumbosacral angle was variable, ranging from 5 to 64 degrees and averaging 35 degrees. More often than not the angle was materially decreased by lumbar spasm and again increased after fasciotomy. Twenty-one (27 per cent) of the patients had roentgenographic evidence of arthritis elsewhere in the body, mostly the spine. It is doubtful whether this is greater than the average in any group of people of this age. However, patients with arthritic spines, while getting as much relief from sciatica, were less likely to get rid of back pain than the non-arthritics.

Significant is the fact that patients who had had sciatica for less than 1 year obtained far better results than those in whom symptoms had been present for a longer period. In this group were 17 patients. Eleven (65 per cent) obtained complete relief, in 2 (12 per cent) sciatica disappeared but back pain remained, 2 (12 per cent) were 50 to 75 per cent improved, 2 (12 per cent) unimproved. These were patients included in groups I and III.

SUMMARY

1. The ideal patient upon whom to do a fasciotomy is one whose predominating symtom is sciatica which has been present for less than 1 year and who shows no roentgenographic evidence of generalized spinal arthritis.

2. There are, however, patients with too extensive spondylitis to justify a spinal fusion in whom a distressing sciatica exists which has failed to respond to non-operative measures. The percentage of these patients who are relieved entirely or in part of their sciatica by a fasciotomy makes it a warrantable procedure.

3. The simplicity of this operation, its minor nature, and the fact that it can be done under local anesthesia make it applicable in many patients whose age and health contraindicate major operative procedures. Likewise, the short period of hospitalization (1 week) and disability enables one to perform a fasciotomy on patients who cannot afford to be economically shelved for the 3 to 5 months required by a spinal fusion.

4. I believe that anyone who has had low back pain and sciatica to a disabling degree, as the writer has, will agree that a fasciotomy is worth while if only 50 per cent relief is obtained. In group I, that had this operation alone performed, 83 per cent were benefited that much or more.

5. The results of this operation are not as satisfactory as those of lumbosacral fusion, an operation that has well stood the test of time.

SPINAL FUSION

Fusion of the lumbosacral spine is done on the theory, now amply proved, that complete elimination of motion will cause cessation of inflammation existing in and around the articulations and intervertebral foramina and relieve supporting muscles and ligaments of a strain they have been unable to bear. We also believe that direct pressure does not produce a radiculitis when motion is not present. The remarkable ability of soft tissues to make an adjustment between themselves and their surrounding bony canal after changes caused by tuberculosis and spinal fractures has often been observed at autopsy.

The first spinal fusion performed at the New York Orthopædic Dispensary and Hospital to relieve a patient of low back and sciatic pain was done in 1914 upon an adolescent girl having spondylolisthesis. From that date until August 1, 1936, this operation was done upon 681 patients. Three of these patients died, a mortality rate of 0.4 per cent. In 2 of the patients death was due to a Streptococcus hæmolyticus septicemia secondary to wound infection. One death followed a postoperative pneumonia. In general the postoperative course of the patients has been as uneventful as one might expect of a clean appendectomy case in the average general hospital. The patients are recumbent for 6 to 8 weeks, wearing a Taylor back brace extending from the buttocks to about the tenth dorsal vertebra. Absolute immobilization of the spine by external means is impossible but a brace does prevent the more gross movements. After getting up, activities may be increased gradually until the brace is discarded about 4 to 5 months after operation. A patient should be able to return to sedentary work within 3 months and to manual work within 4 to 5 months after operation.

The Hibbs type of spinal fusion which was used in all cases is too well known to require further description. However, it might be well to emphasize the following points: (1) It is essential that the cartilage from the posterior articulations be removed and the resultant spaces packed with bone chips. (2) The chips should be numerous and small. The smaller chips increase surface area, thereby hastening decalcification and revascularization. Also motion between individual particles is decreased. Here as elsewhere this is an important factor in insuring early and solid bony union. (3) Usually sufficient bone is obtained if one goes well up on the sacrum and uses the spinous process of the vertebra above the fusion area for additional chips. However, if the supply of bone seems inadequate, more may be obtained from the posterior crest of the ilium. (4) The posterior articulations immediately above the area to be fused must not be exposed as this may lead to a traumatic arthritis. (5) Care should be taken to see that the fusion mass does not impinge upon the lamina and spinous process of the vertebra above.

Before 1928 the fusion area usually extended from the first sacral to the fourth lumbar vertebra. Today, for reasons to be shown later in this paper, the fusion is of the fifth lumbar vertebra only to the sacrum, unless a spondylolisthesis or very definite degenerative changes or mechanical abnormalities exist between the fourth and fifth lumbar vertebra. Likewise, since about the same time we have routinely taken the spinous process of the vertebra above to reinforce the fusion area. Still more recently we have been using bone from the posterior crest of the ilium whenever the posterior spinal elements seem inadequate as a source of bone chips. For these reasons, and because today more care is shown in the selection of cases, our results are now better than is represented in the end-result study given below.

It is difficult to get adequate follow-up examinations on private patients, so only ward patients have been included in this study. All have been followed for a minimum period of 3 years. Many will have occasional aches for 3 to 9 months after operation, then are completely free of symptoms. Others may be well for a period of several years, in 2 cases 10 years, then have a sudden recurrence. Roentgenograms of the latter will usually show a pseudarthrosis. It is well known that under non-operative treatment this syndrome commonly follows a wave-like course with periods of relative quiescence. For these reasons I believe that 3 years is an absolute minimum period in which to follow a patient before drawing a conclusion as to the worthwhileness of this operative procedure.

An attempt was made to determine the end-results from non-operative treatment but the difficulties encountered in keeping contact with patients no longer having symptoms were too great to make this practicable. The literature contains no adequate statistical studies of the results obtained from non-operative treatment of this condition. As long as we must base opinions on impressions we are seldom in a position to advise spinal fusion before an effort has been made to secure relief by other means. At present about 1 in 15 patients treated at this dispensary for sciatica and low back pain has a lumbosacral fusion, and it is perhaps advised in 1 out of 10. It is well to remember when judging end-results from spinal fusions that these were patients who had had severe symptoms. Many were unable to carry on their work; all were definitely handicapped. All had tried non-operative measures to secure relief. Many had been under the care of irregular practitioners as well as legitimate physicians and surgeons. All still suffered so much that they were willing to undergo a major operation and time-consuming convalescence in an effort to obtain a cure.

In this group are 195 patients who were followed for an average period of 5 years and 11 months. One hundred and seventeen were males and 78 females, averaging 32 and 29 years of age, respectively. The extreme range of ages was 11 to 54 years. The length of time symptoms had been present before operation varied from a few weeks to 29 years and averaged 5½ years. It is to be noted that the age average in this group is considerably below that for patients treated without operation or by means of a fasciotomy.

One hundred and thirty-eight (70.8 per cent) obtained an excellent result. By this is meant that relief was complete or symptoms were confined to an occasional ache such as any one might have following prolonged physical effort. Usually a patient had some backache and occasional twinges of sciatica for 3 to 9 months after the operation. These postoperative aches are probably due to the prolonged period of bed rest and back immobilization or to secondary fascial adhesions and other inflammatory changes remaining after the primary causative factor has been removed. Nine of the patients had some roentgenographic evidence of generalized spinal osteo-arthritis, but in none were the symptoms from this source more than mild.

Fourteen (7.2 per cent) of the patients had 75 to 90 per cent relief, and this might be considered a good result. In analyzing this group in an effort to find why relief had not been complete, the following facts were disclosed:

a. In one the fusion mass impinged upon the spinous process and vertebra above the fusion.

b. In 4 patients pseudarthroses existed clinically and by roentgenogram.

c. One patient had generalized migratory joint and muscle pains.

d. One was an extreme neurasthenic, a diagnosis one dislikes to make but probably correct and the cause of continued symptoms in this case.

e. This man had a markedly shortened lower extremity and recurrent chronic osteomyelitis of the femur. He was of poor physique and posture.

f. There were 6 patients in whom no apparent reason for the incompleteness of relief was discovered.

Seventeen (8.7 per cent) of the patients had a 50 to 75 per cent lessening of their preoperative symptoms. Analyzing this group it was found that:

a. Five had pseudarthroses clinically and by roentgenogram.

b. Two more had had pseudarthroses repaired but did not obtain complete relief.

c. This man had a wound infection which drained for 15 months.

d. Three patients had generalized spinal and sacro-iliac arthritis. One of these was completely relieved 5 years later by a fasciotomy.

e. This man had a chronic prostatitis and an extensive pyorrhea.

f. Several abscessed teeth were removed from this patient some years after operation. He complained of generalized joint aches and pains.

g. In 4 patients I could find no apparent reason for the incompleteness of their relief.

Twenty-six (13.3 per cent) of the patients had little or no relief. As far as one can determine none of the patients was made worse. Of the 26 patients:

a. Two had pseudarthroses clinically and by roentgenogram but refused repair.

b. Nine had attempts made to repair their pseudarthroses. This group is described in more detail later.

c. One woman should have had the fourth lumbar vertebra added because of an extremely acute angle and oblique articulations. She was an extremely nervous individual and inclined to neurasthenia.

d. Nine patients had generalized spinal and sacro-iliac arthritis, often accompanied by obvious foci of infection such as teeth, sinuses, throat, and prostate.

e. This patient had a tuberculous infection involving the intervertebral disc between the fourth and fifth lumbar vertebræ. This point of infection was not visible roentgenographically until several months after operation. The fusion was then extended to the second lumbar vertebra. The patient is symptomless today. In the 681 patients there were 2 others in whom a similar mistake was made.

f. A woman whom several neurologists have diagnosed as having an adhesive arachnoiditis.

g. A man who later developed a typical spondylitis ankylopoietica of the entire spine.

h. It is now obvious that this patient's symptoms came from his dorsolumbar spine, where osteo-arthritis and a slight structural scoliosis existed, and there was no indication for a lumbosacral fusion.

i. This patient was completely freed of his symptoms several years later by a fasciotomy. No reason for the failure of the spinal fusion was apparent.

The presence of generalized arthritis and of foci of infection has been listed as a reason for failure to obtain complete cure following spinal fusion, though the writer is well aware that he has not definitely proved that these are causative factors. But in view of the relative absence of these factors in those obtaining complete relief he feels that it is logical to assume that they are major reasons for the continuance of symptoms in the presence of a solid fusion.

From this analysis it can be seen that where one has not relieved a patient of his low back symptoms and sciatica, the patient has nearly always been ill chosen or a definite pseudarthrosis exists in the fusion area.

SELECTION OF PATIENTS UPON WHOM TO DO A SPINAL FUSION

The patients were divided into groups according to the types of anomalous and degenerative changes present. It was found that no essential differences existed in these groups as to the type or severity of symptoms present and the degree of relief obtained by fusing the spine. Patients having thin intervertebral discs between first sacral and fifth lumbar or fourth and fifth lumbar in whom the likelihood of a posterior herniation of the disc was greatest obtained as good results as as that secured for the all groups average. The only differences in the groups were that those having spondylolisthesis or a transitional fifth lumbar vertebra in which the fusion extended from the first sacral to the fourth lumbar had a higher percentage of pseudarthroses and a proportional rise in the number of failures. Age did not affect the incidence of pseudarthrosis. The results obtained were slightly better in young adults, but this was about proportionate to the greater incidence of generalized osteo-arthritis and more frequent foci of infection in the older. Likewise, older patients had more difficulty in ambulating and in regaining their strength after operation. Spinal fusions in patients over 55 years of age are seldom warranted.

While there is no relationship between preoperative roentgenographic findings and the results obtained at operation, it is generally the opinion of members of the New York Orthopædic Dispensary and Hospital staff that patients having spondylolisthesis, an atrophic intervertebral disc which is associated with an osteo-arthritis, an abnormally acute lumbosacral angle, severe posterior displacement of the fifth lumbar vertebra, a transitional vertebra, or extreme asymmetry of the lumbosacral joints respond least well to non-operative treatment. At present we have no statistical evidence to support this, it being difficult to follow an unselected group of patients not operated upon over an adequate period of time.

Many clinics today are discovering an unusually high incidence of herniations of the intervertebral disc posteriorly in patients having sciatica. It is well therefore to do spinal punctures and, if necessary, lipiodol injections on all upon whom a spinal fusion is contemplated. As previously stated, there is reason to believe that arthrodesis of the spine to include the area with the involved disc is a good procedure. It will be interesting to see if patients with definite lipiodol evidence of disc protrusion are relieved by spinal fusion alone.

In the selection of patients the following points must be kept in mind: (1) Those having generalized spinal arthritis are much less likely to get a complete cure. However, if pain is severe and well localized it may be feasible to fuse such a patient with the understanding that a lumbosacral fusion does not rid one of pain in the upper lumbar, dorsal, or cervical spine. (2) A careful search for and, if possible, elimination of foci of infection should be made before the spine is fused. (3) Conditions such as spinal cord tumors, tuberculosis, spondylitis ankylopoietica (early stages), and the possibility of causative factors higher in the spinal column must be kept in mind.

PSEUDARTHROSES

In 195 patients having lumbosacral fusions and followed after operation for a minimum period of 3 years and an average of 5 years and 11 months, there were 25 (12.8 per cent) in whom pseudarthroses were demonstrated at subsequent operations. An additional 11 (5.6 per cent) had roentgenographic and clinical evidence of pseudarthroses and 5 (2.6

SITES OF PSEUDARTHROSES

Fusions of the first sacral to fourth lumbar and first sacral to third or second lumbar	1 pseudarthrosis between first sacral and fifth lumbar only.
	7 pseudarthroses between fourth and fifth lumbar only.
	11 pseudarthroses between both fourth and fifth lumbars and first sacral and fifth lumbar.
	1 pseudarthrosis between the third and fourth lumbar.

per cent) very definite roentgenographic findings but no symptoms, making a total of 21 per cent of the whole group. Significant is the fact that only 6.2 per cent of the 80 fusions that extended from first sacral to fifth lumbar had pseudarthroses, while in the 93 going from first sacral to fourth lumbar and the 22 going from first sacral to third lumbar or second lumbar, the incidence was 31.2 per cent and 31.6 per cent, respectively. If one excludes from the latter two groups patients having spondylolisthesis, the incidence is 28.8 per cent. This is still 4.6 times as many failures of fusion as when the area arthrodesed goes from the first sacral to the fifth lumbar only. In spondylolisthesis the posterior elements are underdeveloped and very mobile, making fusion difficult. In the 42 patients having this condition 35.7 per cent had pseudarthroses proved at operation or revealed in roentgenograms.

The sites of pseudarthroses in cases proved at operation is shown in the chart above. A few of these were not visible roentgenographically but the patients were operated upon because of clinical findings. The 5 with fusions of first sacral to the fifth lumbar of course had pseudarthroses at that site.

Of the 25 patients who had attempts made to repair the pseudarthroses 11 (44 per cent) had complete relief from symptoms, though 3 did so only after a second repair.

Five (20 per cent) had 50 to 90 per cent relief. Two of these later obtained complete relief from a fasciotomy. One had a generalized spinal arthritis and one recurrent chronic osteomyelitis of the femur in a greatly shortened lower extremity.

Nine (36 per cent) failed to be benefited by the repair. In 2 of these a pseudarthrosis is still evident roentgenographically, in 7 the fusion appears solid. It is to be remembered, however, that it is difficult to tell by roentgenogram whether or not a repair is solid. Of the latter 7, 1 has since been relieved completely by a fasciotomy, 2 have generalized spinal and sacro-iliac arthritis, and in 4 I can find no reason for continued symptoms.

The high incidence of pseudarthroses, as well as the difficulties encountered in trying to effect a repair, is discouraging. Until about 1928 it was customary to extend the fusion from first sacral to the fourth lumbar routinely, a practice now given up for obvious reasons. Certainly all cases of spondylolisthesis and many others would benefit by the addition of small bone chips from the posterior crest of the ilium and this is now being done often. Great care should be taken in removing the articular cartilage and filling the resultant spaces with bone chips. In repairing a pseudarthrosis the fibrous tissue must be removed from the crack and bone chips packed in. In addition, attached chips should be turned up over the entire fusion area, insuring a wider band of attachment of the newly formed bone to the old, for they will differ in architecture and therefore represent a point of weakness for several months.

CONCLUSION

Low back pain and sciatica are commonly due to an unstable fifth lumbar vertebra which has placed upon supporting muscles, ligaments, and joints, a load they are unable to carry. This instability is further increased by the congenital anomalies and degenerative changes common to this area of the spine.

The majority of patients will obtain sufficient relief from the non-operative measures outlined to make operation unwarranted.

Tensor fasciæ fasciotomy is a useful adjunct to our therapeutic armamentarium and is indicated in selected cases. It is well not to be too positive of its curative effect until several more years are added to the period of observation of patients after operation.

The presence of generalized arthritis and of foci of infection has been listed as a reason for failure to obtain complete cure following spinal fusion, though the writer is well aware that he has not definitely proved that these are causative factors. But in view of the relative absence of these factors in those obtaining complete relief he feels that it is logical to assume that they are major reasons for the continuance of symptoms in the presence of a solid fusion.

From this analysis it can be seen that where one has not relieved a patient of his low back symptoms and sciatica, the patient has nearly always been ill chosen or a definite pseudarthrosis exists in the fusion area.

SELECTION OF PATIENTS UPON WHOM TO DO A SPINAL FUSION

The patients were divided into groups according to the types of anomalous and degenerative changes present. It was found that no essential differences existed in these groups as to the type or severity of symptoms present and the degree of relief obtained by fusing the spine. Patients having thin intervertebral discs between first sacral and fifth lumbar or fourth and fifth lumbar in whom the likelihood of a posterior herniation of the disc was greatest obtained as good results as as that secured for the all groups average. The only differences in the groups were that those having spondylolisthesis or a transitional fifth lumbar vertebra in which the fusion extended from the first sacral to the fourth lumbar had a higher percentage of pseudarthroses and a proportional rise in the number of failures. Age did not affect the incidence of pseudarthrosis. The results obtained were slightly better in young adults, but this was about proportionate to the greater incidence of generalized osteo-arthritis and more frequent foci of infection in the older. Likewise, older patients had more difficulty in ambulating and in regaining their strength after operation. Spinal fusions in patients over 55 years of age are seldom warranted.

While there is no relationship between preoperative roentgenographic findings and the results obtained at operation, it is generally the opinion of members of the New York Orthopædic Dispensary and Hospital staff that patients having spondylolisthesis, an atrophic intervertebral disc which is associated with an osteo-arthritis, an abnormally acute lumbosacral angle, severe posterior displacement of the fifth lumbar vertebra, a transitional vertebra, or extreme asymmetry of the lumbosacral joints respond least well to non-operative treatment. At present we have no statistical evidence to support this, it being difficult to follow an unselected group of patients not operated upon over an adequate period of time.

Many clinics today are discovering an unusually high incidence of herniations of the intervertebral disc posteriorly in patients having sciatica. It is well therefore to do spinal punctures and, if necessary, lipiodol injections on all upon whom a spinal fusion is contemplated. As previously stated, there is reason to believe that arthrodesis of the spine to include the area with the involved disc is a good procedure. It will be interesting to see if patients with definite lipiodol evidence of disc protrusion are relieved by spinal fusion alone.

In the selection of patients the following points must be kept in mind: (1) Those having generalized spinal arthritis are much less likely to get a complete cure. However, if pain is severe and well localized it may be feasible to fuse such a patient with the understanding that a lumbosacral fusion does not rid one of pain in the upper lumbar, dorsal, or cervical spine. (2) A careful search for and, if possible, elimination of foci of infection should be made before the spine is fused. (3) Conditions such as spinal cord tumors, tuberculosis, spondylitis ankylopoietica (early stages), and the possibility of causative factors higher in the spinal column must be kept in mind.

PSEUDARTHROSES

In 195 patients having lumbosacral fusions and followed after operation for a minimum period of 3 years and an average of 5 years and 11 months, there were 25 (12.8 per cent) in whom pseudarthroses were demonstrated at subsequent operations. An additional 11 (5.6 per cent) had roentgenographic and clinical evidence of pseudarthroses and 5 (2.6

SITES OF PSEUDARTHROSES

Fusions of the first sacral to fourth lumbar and first sacral to third or second lumbar	1 pseudarthrosis between first sacral and fifth lumbar only.
	7 pseudarthroses between fourth and fifth lumbar only.
	11 pseudarthroses between both fourth and fifth lumbars and first sacral and fifth lumbar.
	1 pseudarthrosis between the third and fourth lumbar.

per cent) very definite roentgenographic findings but no symptoms, making a total of 21 per cent of the whole group. Significant is the fact that only 6.2 per cent of the 80 fusions that extended from first sacral to fifth lumbar had pseudarthroses, while in the 93 going from first sacral to fourth lumbar and the 22 going from first sacral to third lumbar or second lumbar, the incidence was 31.2 per cent and 31.6 per cent, respectively. If one excludes from the latter two groups patients having spondylolisthesis, the incidence is 28.8 per cent. This is still 4.6 times as many failures of fusion as when the area arthrodesed goes from the first sacral to the fifth lumbar only. In spondylolisthesis the posterior elements are underdeveloped and very mobile, making fusion difficult. In the 42 patients having this condition 35.7 per cent had pseudarthroses proved at operation or revealed in roentgenograms.

The sites of pseudarthroses in cases proved at operation is shown in the chart above. A few of these were not visible roentgenographically but the patients were operated upon because of clinical findings. The 5 with fusions of first sacral to the fifth lumbar of course had pseudarthroses at that site.

Of the 25 patients who had attempts made to repair the pseudarthroses 11 (44 per cent) had complete relief from symptoms, though 3 did so only after a second repair.

Five (20 per cent) had 50 to 90 per cent relief. Two of these later obtained complete relief from a fasciotomy. One had a generalized spinal arthritis and one recurrent chronic osteomyelitis of the femur in a greatly shortened lower extremity.

Nine (36 per cent) failed to be benefited by the repair. In 2 of these a pseudarthrosis is still evident roentgenographically, in 7 the fusion appears solid. It is to be remembered, however, that it is difficult to tell by roentgenogram whether or not a repair is solid. Of the latter 7, 1 has since been relieved completely by a fasciotomy, 2 have generalized spinal and sacro-iliac arthritis, and in 4 I can find no reason for continued symptoms.

The high incidence of pseudarthroses, as well as the difficulties encountered in trying to effect a repair, is discouraging. Until about 1928 it was customary to extend the fusion from first sacral to the fourth lumbar routinely, a practice now given up for obvious reasons. Certainly all cases of spondylolisthesis and many others would benefit by the addition of small bone chips from the posterior crest of the ilium and this is now being done often. Great care should be taken in removing the articular cartilage and filling the resultant spaces with bone chips. In repairing a pseudarthrosis the fibrous tissue must be removed from the crack and bone chips packed in. In addition, attached chips should be turned up over the entire fusion area, insuring a wider band of attachment of the newly formed bone to the old, for they will differ in architecture and therefore represent a point of weakness for several months.

CONCLUSION

Low back pain and sciatica are commonly due to an unstable fifth lumbar vertebra which has placed upon supporting muscles, ligaments, and joints, a load they are unable to carry. This instability is further increased by the congenital anomalies and degenerative changes common to this area of the spine.

The majority of patients will obtain sufficient relief from the non-operative measures outlined to make operation unwarranted.

Tensor fasciæ fasciotomy is a useful adjunct to our therapeutic armamentarium and is indicated in selected cases. It is well not to be too positive of its curative effect until several more years are added to the period of observation of patients after operation.

Of the operative measures a lumbosacral spinal fusion is the most satisfactory and is indicated in about 10 per cent of the patients. Improved operative technique and better selection of patients should enable one to raise the percentage of cures definitely above that found in the group presented here.

REFERENCES

1. Beadle, O. A. The intervertebral discs. Medical Research Council Special Report. Series No. 161. London: H. M. Stationery Office, 1931.
2. Brailsford, J. F. The Radiology of Bones and Joints. Baltimore: William Wood & Co., 1934.
3. Danforth, M. S., and Wilson, P. D. The anatomy of the lumbosacral region in relation to sciatic pain. J. Bone & Joint Surg., 1925, 7: 109–160.
4. Duncan, G. A. Personal communications.
5. Ferguson, A. B. The clinical and roentgenographic interpretation of lumbosacral anomalies. Radiology, 1934, 22: 548.
6. Frieburg, A. H., and Vinke, T. H. Sciatica and the sacro-iliac joint. J. Bone & Joint Surg., 1934, 16: 126–136.
7. Golding, F. C. Spondylitis ankylopoietica. Brit. J. Surg., 1936, 23: 484–500.
8. Goldthwait, J. E. The lumbosacral articulation; an explanation of many cases of "lumbago," "sciatica" and paraplegia. Boston M. & S. J., 1911, 164: 365.
9. Goldthwait, J. E., and Osgood, R. B. A consideration of the pelvic articulations from an anatomical, pathological and clinical standpoint. Boston M. & S. J., 1905, 152: 593–634.
10. Heyman, C. H. Thoughts on relief of sciatic pain. J. Bone & Joint Surg., 1934, 16: 889–894.
11. Hibbs, R. A., and Swift, W. E. Developmental abnormalities at the lumbosacral juncture causing pain and disability, etc. Surg., Gynec. & Obst., 1929, 48: 604–612.
12. Hilton, J. Rest and Pain. 2d ed. New York: William Wood & Co., 1879.
13. Johnson, R. W. Jr. Posterior luxations of lumbosacral joint. J. Bone & Joint Surg., 1934, 16: 867.
14. Junghanns, H. Die Spondylolisthese in Roentgenbild. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1930, 41: 239–245.
15. Kimberley, A. G. Low back pain: its etiology, diagnosis, treatment. West. J. Surg., 1935, 43: 699.
16. Lackum, H. L. von. The lumbosacral region. An anatomic study and some clinical observations. J. Am. M. Ass., 1924, 82: 1109–1114.
17. Middleton, G. S., and Teacher, J. H. Injury of the spinal cord due to rupture of an intervertebral disc during muscular effort. Glasgow M. J., 1911, 76: 139.
18. Mitchell, G. A. G. The lumbosacral junction. J. Bone & Joint Surg., 1934, 16: 233–254.
19. Idem. Lumbosacral strain. Lancet, 1936, 1: 75–80.
20. Idem. The significance of lumbosacral transitional vertebræ. Brit. J. Surg., 1936, 24: 147–158.
21. Mixter, W. J., and Ayer, J. B. Herniation or rupture of the intervertebral disc into spinal canal. New England J. Med., 1935, 213: 385–393.
22. Mixter, W. J., and Barr, J. S. Rupture of the intervertebral disc with involvement of the spinal canal. New England J. Med., 1934, 211: 210–214.
23. Neugebauer, F. Spondylolisthesis et Spondylizeme. Paris: G. Steinheil, 1892.
24. Ober, F. R. Back strain and sciatica. J. Am. M. Ass., 1935, 104: 1580–1582.
25. Idem. Rôle of ilio-tibial band and fascia lata as factor in causation of low back disabilities and sciatica. J. Bone & Joint Surg., 1936, 18: 105–110.
26. Perrier, J. G. Étude radio-clinique du carrefour lumbo-sacroiliaque. Thèses de la Faculté de Méd. de Par., 1929, 36.
27. Pitkin, H. C., and Pheasant, H. C. Sacrarthrogenetic telalgia; study of referred pain. J. Bone & Joint Surg., 1936, 18: 111–133.
28. Schmorl, G., and Junghanns, H. Archiv und Atlas der normalen und pathologischen Anatomie in typischen Rontgenbildern. Leipzig: Georg Thieme, 1932.
29. Sicard, Haguenau, and Wallich. Spondylolisthesis et attelle osseuse, retro-spondylolisthesis. Syndrome de l'érection des apophyses epineuses lombaires. Rev. de neurol., 1928, March 25.
30. Smith, A. De F. Pain in the low back caused by structural variations in the spine. New Jersey M. Soc. J., 1929, 26: 523–527.
31. Idem. Posterior displacement of fifth lumbar vertebra. J. Bone & Joint Surg., 1934, 16: 877–888.
32. Williams, P. C., and Yglesias, L. Lumbosacral facetectomy for postfusion persistent sciatica. J. Bone & Joint Surg., 1933, 15: 579.
33. Willis, T. A. The lumbosacral vertebral column in man, its stability of form and function. Am. J. Anat., 1923, 32: 95–123.
34. Idem. Vertebral anomalies. Am. J. Surg., 1929, 6: 163–168.
35. Idem. Separate neural arch. J. Bone & Joint Surg., 1931, 13: 709–721.
36. Idem. Backward displacement of fifth lumbar vertebra: optical illusion. J. Bone & Joint Surg., 1935, 17: 347–352.

CLINICAL SURGERY

FROM THE DEPARTMENT OF SURGERY, UNIVERSITY OF NEBRASKA COLLEGE

TECHNIQUE OF IMMEDIATE CHOLANGIOGRAPHY

R. RUSSELL BEST, M.D., F.A.C.S., and N. FREDERICK HICKEN, M.D., Omaha, Nebraska

DURING the past 2 years, our experiences with cholangiography have led to certain improvements and refinements which we believe have greatly simplified the technique. As in the development of any technical procedure, these improvements have been brought about by trial and error, and we are fully aware that the investigations of others will also add valuable information. It has been found, too, that all contrast mediums can be utilized, but some because of their greater fluidity are easier to inject, while the heavier oily solutions seem to possess definite therapeutic properties. Since it is not the purpose of this paper to discuss the many values of cholangiography, it will suffice to say that time and experience have proved this method of visualizing the biliary tract increasingly practicable as a diagnostic aid. It has not only enlightened us about common duct pathology, but it has given us a clearer understanding of some of the failures following cholecystectomy, and has enabled us to relieve certain patients of an upper abdominal syndrome which would have relegated them to that group not benefited by gall-bladder surgery. It was observing delayed cholangiograms that prompted us to introduce the use of nitroglycerin tablets in relieving spasm of the sphincter of Oddi at the last meeting of the American Medical Association.

Immediate cholangiography is not a difficult or complicated procedure. It can be carried out in any hospital where there is a mobile or bedside x-ray unit, and once an immediate cholangiogram has been taken, the mere assembling of physical equipment becomes quite simple. The necessary articles are enumerated as follows: a bedside x-ray unit, a 14 by 17 double screen casette, and a wooden tunnel such as is found in most x-ray departments and which is sufficiently large to admit the casette. On the instrument table, in addition to the usual gall-bladder set up, there should be a large sterile sheet, 25 cubic centimeters of 48 per cent hippuran solution, a 10 cubic centimeter syringe with a 23-gauge needle, and a 20 cubic centimeter LuerLok syringe with a 1¼ inch, 22-gauge, short beveled needle (preferably, though not necessarily, the special needle with a metal bead ⅛ inch from the point). These articles should be assembled in the operating room before the anesthesia is started, so they will be immediately available.

The wooden tunnel containing the casette and the film is placed beneath the patient. We have built padded inclines at either end of the tunnel, for the patient's comfort (Fig. 1). The tunnel expedites the removal of the casette and the introduction of another, should a second exposure be desired. We have taken many cholangiograms at the table, however, by merely placing the casette in the correct position under the patient before starting the anesthesia.

After the routine incision and exploration, the common duct is carefully palpated and, if no stones can be felt, it is immediately exposed. Isolation of the duct is more easily accomplished by incising the hepatoduodenal ligament near the junction of the cystic and common ducts and separating the margins of the peritoneum. Using the 23-gauge needle on the 10 cubic centimeter syringe, the exposed structure is definitely established as the common duct by withdrawing bile into the syringe. Since the amount of bile within the duct determines the dilution of the contrast medium, the plunger is drawn back as long as bile can be aspirated. The common duct is then gently grasped with two Allis forceps, one on either side of the small puncture wound made by the exploratory needle, and the field is ready for injection of the contrast medium.

A 22-gauge, short beveled needle, 1¼ inches long, has been found most practical for injection purposes. During the last few months, we have been using a needle which has a small bead ⅛ inch from the point (Fig. 2). The bead lends security in locating the end of the needle so it does not pierce the posterior wall of the common duct.

Experience has proved that the iodized oils which were first used as contrast mediums are difficult to introduce through small needles be-

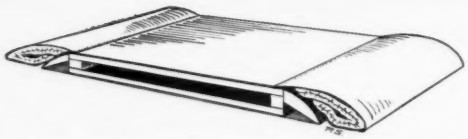


Fig. 1. X-ray tunnel with inclines attached to ends. For greater comfort, a slip covering with the ends padded with silence cloth fits over the tunnel.

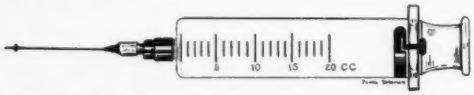


Fig. 2. For injection of the radiopaque solution, a 22-gauge, short beveled needle, 1¼ inches long, with a small metal bead ⅛ inch from the point, is attached to a 20 cubic centimeter LuerLok syringe.

cause of their viscosity and the question also arises whether this density may not obscure the smaller common duct stones. These oils do appear to have definite therapeutic value, however, and all patients with biliary fistulas and those with T tubes or catheters in the common duct receive one or more postoperative instillations of lipoiodine through the tract or tube. For over a year, we have been using hippuran, which is a 48 per cent aqueous solution of organic iodide. Its fluidity permits it to be injected with ease, it casts a clear, definite shadow, and it does not appear to be irritating. Hippuran may be obtained in 25 cubic centimeter ampuls or in powder form, the latter being more economical. Twelve grams of the powder are dissolved in a little more than 25 cubic centimeters of distilled water, and the solution is sterilized by boiling.

By means of the 22-gauge needle attached to the Lok syringe, the contrast solution is injected at the point where the exploratory puncture was made in the common duct (Fig. 3). If the special needle with the bead is used, one can gently plunge it to the depth of the bead, but when the plain needle is used care must be taken not to pierce the posterior wall of the common duct. One-eighth of an inch is deep enough in most instances. The amount of contrast medium injected varies somewhat with the size of the duct. From 10 to 20 cubic centimeters may be used, 15 cubic centimeters being an average amount. At times it has been possible to inject only 5 cubic centimeters and in some instances where the duct was not dilated, a satisfactory picture was obtained. However, the contrast is usually too weak with this amount and could lead to error.

After the needle is withdrawn, the Allis clamps are released and the puncture wound is gently

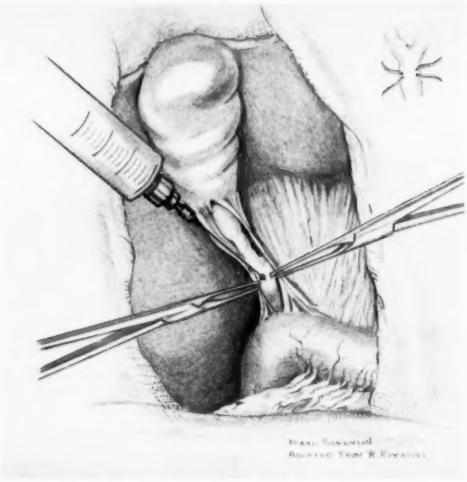


Fig. 3. The common duct is isolated and the radiopaque solution injected directly into the duct.

sponged. The towel clips at the upper angle of the wound are removed as they may overshadow the common duct. The self-retaining retractor may or may not be removed. The large sterile sheet is then thrown over the entire operative field, the operator and assistants step aside and the x-ray unit is centered over the gall-bladder area. After the cholangiogram is taken, the film is removed from the tunnel and is immediately developed. The surgeon, unless there is gross contra-indication, proceeds with the removal of the gall bladder in the routine manner. Within 5 to 10 minutes, before removal of the gall bladder is completed, the film is returned to the operating room for interpretation.

If the common duct appears clear and unobstructed, with no suggestion of stone, stricture, or neoplasm, one can close the abdomen confident that the common duct, which plays such an important part in that group of cases not benefited by biliary surgery, has been as thoroughly explored as the more accessible gall bladder. Furthermore, this has been accomplished without injury, for incision and instrumentation of the common duct do cause injury or stricture at times. It has been proved to our own satisfaction that a lurking stone or stones may be revealed in the cholangiogram when palpation and visualization are negative.

If the film demonstrates the presence of stones, choledocholithotomy is performed in the routine manner, and a T tube is inserted into the duct.

In two instances when multiple small stones had been removed from the common duct, a delayed cholangiogram taken after several days showed stones still present. Consequently, we now feel that one should seriously consider taking a second cholangiogram after the catheter or T tube has been fixed into the common duct to determine whether any stones or other obstruents have been overlooked. This may eliminate some secondary operation in those cases in which small stones may have been disregarded. About 20 cubic centimeters of hippuran solution should be instilled through the catheter or T tube for the second exposure.

If stones can be palpated in the common duct at the beginning of the operation, there is no need for a diagnostic cholangiogram. However, after all apparent stones have been removed and the catheter or tube is in place, the check-up cholangiogram is a safeguard against possible remaining disease. This is particularly true if multiple stones have been found.

In every instance in which a catheter or T tube is placed in the common duct, a delayed cholangiogram should be made within a week, regardless of whether an immediate cholangiogram has been made at the table. The satisfaction one derives and the information obtained regarding the pathology and physiology of the duct certainly warrant this postoperative recheck.

BIBLIOGRAPHY

1. BEST, R. R., and HICKEN, N. F. Biliary dyssynergia: physiological obstruction of the common bile duct. Surg., Gynec. & Obst., 1935, 61: 721–734.
2. Idem. Biliary dyssynergia: cholangiographic recognition and its significance. Western J. Surg., 1936, Aug.
3. Idem. Cholangiographic demonstration of biliary dyssynergia; and other obstructive lesions of the gall bladder and bile ducts. J. Am. M. Ass., 1936, 107: 1615–1619.
4. HICKEN, N. F., BEST, R. R., and HUNT, H. B. Cholangiography: visualization of the gall bladder and bile ducts during and after operation. Ann. Surg., 1936, 103: 210–229.
5. ROBBINS, S. A., and HERMANSON, L. Cholangiography. Surg., Gynec. & Obst., 1936, 62: 684–688.

LIPIODOL VISUALIZATION OF THE BILE TRACTS IN LESIONS WITH JAUNDICE

HILLIER L. BAKER, M.D., AND CHARLES M. BACON, M.D., Chicago, Illinois

VISUALIZATION of the biliary tract is a very helpful procedure in determining the patentcy of the bile ducts. Visualization may be done at operation or any time later if drainage is instituted. By this means, obstructive lesions which are overlooked or unsuspected may be discovered, such as stone, stricture, or pressure on the ducts by tumor, or the duct may be shown to be unobstructed, thus lessening operative interference. In a group of cases in which jaundice was present in varying degrees, we have employed visualization.

The interpretation of our findings were at times at variance with our clinical impressions. This is not difficult to explain, however, for as one reviews the literature on this subject, he is impressed with the wide variance of interpretations.

Visualization has shown the effect of drugs on the sphincter of Oddi. Spasm of the sphincter of Oddi has been demonstrated. Many of the older concepts as to the influence of the sphincter mechanism have been made clear. This will probably result in change in treatment, both medical and surgical, in gall-tract disease.

The cases we wish to report are those in which jaundice was due to chronic pancreatitis, carcinoma of the head of the pancreas, and stricture of the common duct, in which the findings were suspected at operation and verified both by visualization or reoperation. Other cases included perforation of the gall bladder in which drainage had been done and those in which common duct stones were removed with T-tube drainage. Visualization was carried out before the drain tube was removed so that chronic pancreatitis or other pathology would not be overlooked.

Lipiodol warmed in a water bath to 99 to 100 degrees F. in amounts varying from 10 to 20 cubic centimeters, was injected into the drain tube just above the skin margin of the wound, the tube being clamped above the site of injection so that the lipiodol solution would not be wasted. In cholecystotomy a Pezzer catheter was used and invaginated by pursestring sutures. This makes a nearly leak proof drain. Twenty cubic centimeters of lipiodol, when injected with a Luer syringe with slow ordinary pressure, fills the bile ducts. When the common duct is injected through a T-tube, 10 to 12 cubic centimeters suffices, unless there is a marked dilatation of the ducts, in which case more lipiodol will be required. Too rapid injection of the contrast material may cause pain or may cause a condition resembling shock, as is described later.

From The Rush Medical College.

The following are histories of patients in whom visualization has been done.

CASE 1. Male, aged 40 years, entered the Presbyterian Hospital February 25, 1935. For 5 years he had been treated for duodenal ulcer. That evening, the patient was nauseated, vomited a small amount of clear fluid, and had a severe pain in the abdomen which doubled him up. Temperature has 98.4 degrees; pulse, 80; white blood cells 15,100. The abdomen, on physical examination, had a hard, boardlike feeling, especially marked in the right upper quadrant. Physical examination was otherwise negative. A quarter grain of morphine was given, the abdomen remaining rigid and tender. A diagnosis of ruptured peptic ulcer was made, and the patient was operated upon February 25, 1935.

Operation. When the abdomen was opened, there was a gush of clear colored fluid. The gall bladder was tense, and a stone could be palpated in the cystic duct. There was a great deal of swelling about the gastrohepatic omentum, and a blood-tinged fluid was seen when the finger was introduced into the foramen of Winslow. Two small stones were removed from the gall bladder. An impacted stone in the cystic duct was removed by an incision of the duct, and the duct was sutured. No stones could be palpated in common or hepatic ducts. Because of the acute pancreatitis, the gall bladder was drained. Culture of the gall-bladder bile showed no growth. Following operation, the patient complained of severe upper abdominal pain at intervals, which necessitated an opiate. There was no bile drainage until the sixth postoperative day, when 650 cubic centimeters was collected. Following this, the patient became more comfortable and he was discharged from the hospital 12 days after admission.

The patient was instructed to clamp the drainage tube two or three times daily so that obstruction of the duct could be ruled out. He said that after the tube was closed for 2 or 3 hours, especially following meals, he had a sensation of fullness in the upper right quadrant and in the back, which compelled him to open the tube, and when the bile flowed from the tube he felt relieved. This sensation gradually disappeared and, on March 22, 1935, the patient said he had the tube clamped for 7 days. There was no discomfort and his stools and urine were normal. No icterus of the skin or conjunctiva could be noted. Because of his postoperative discomfort, 10 cubic centimeters of lipiodol was injected into the drainage tube of the gall bladder. In Figure 1, lipiodol is seen to fill the hepatic, cystic and common ducts, and the gall bladder. Figure 2 was made one-half hour after a fat meal, and shows a small amount of lipiodol in the small bowel, though the gall ducts are still

Fig. 1. Lipiodol fills the gall bladder, cystic, hepatic, and common duct, filling defect in the pancreatic portion of duct.

Fig. 2. Thirty minutes after fat meal. Lipiodol is seen in the duodenum.

filled. Figure 3 was taken 1 hour after 1/100 grain atropine sulphate was given hypodermically. Here the bile ducts are fairly well emptied. The tube was removed from the gall bladder, as it was thought the ducts were patent.

The patient returned to the hospital 1 month later, April 23, 1935. He complained of severe right upper quadrant pain which was referred to the back and shoulder blade, and which was relieved by morphia.

The skin and sclera were deeply jaundiced. Itching was intolerable. The urine was dark with bile and repeated stool examinations failed to reveal any bile. Wassermann and Kahn tests were negative. White blood cells numbered 8,800; hemoglobin was 70; red blood cells, 4,300,000. Temperature was 98.6 degrees; pulse, 88. Bleeding time was 5½ minutes, coagulation time, 40 seconds.

After 4 days' observation, exploration was advised, a tentative diagnosis of common duct stone having been made.

On exposure of the bile ducts, no obstruction could be palpated. The head of the pancreas was uniformly thickened. The common duct was opened and explored, and a catheter passed into the duct was felt in the duodenum. It was thought a small stone could be felt in the ampulla, but that the stone had passed into the bowel. A T-tube was placed in the duct and sutured in place, and the abdomen was then closed.

The postoperative course was uneventful. Bile drainage from the tube averaged about 500 cubic centimeters daily. The stool gradually became normal. The jaundice receded. The patient left the hospital 25 days later. Cultures of bile showed the Bacillus coli.

The T-tube was allowed to remain in place, and for 2 weeks before lipiodol visualization of the tracts, the tube

Fig. 3. One hour after 1/100 atropine sulphate was injected hypodermically ducts are nearly free of lipiodol.

Fig. 4. Lipiodol injected into T-tube passes at once into the duodenum.

Fig. 5. One hour after fat meal bile tract is nearly entirely free of lipiodol.

was clamped off. No external drainage of bile occurred. The sensation of fullness which the patient complained of at previous operation, gradually disappeared.

Fig. 4 and 5. Six cubic centimeters of lipiodol was injected through the T-tube into the bile tract. A film taken immediately (Fig. 4) shows the lipiodol in the duodenum; 1 hour later after a fat meal (Fig. 5), the tracts are entirely free of lipiodol. The thin stricture-like shadow of the duct in the region of the head of the pancreas had disappeared. The T-tube was allowed to remain in place for 2 more weeks. The icterus index was 25. The tube was removed. The patient has remained in good health since the removal of the tube.

From a study of the lipiodol visualization, the finding of acute inflammatory changes in the pancreas and subsequent history, it seems that the resulting complications developing in this case are due to a pancreatitis with pressure on the bile ducts with resultant jaundice. The pain accompanying the closure of the drainage tube was due undoubtedly to back pressure of bile.

The next case so illustrates. This patient had the type of silent jaundice in which doubt arises as to whether we are dealing with a non-obstructive or obstructive jaundice.

CASE 2. Mrs. E. C., 44 years of age, a patient of Dr. C. M. Bacon, entered the Presbyterian Hospital May 12, 1935. In March, the patient had an attack of indigestion, and a few days later she had a pain in the epigastrium that doubled her up. The pain persisted for 4 hours, but did not radiate. She felt nauseated, but did not vomit. The distress passed off and from time to time she had had "vague uneasiness" after eating, especially fatty foods.

Since April, 1935, she noted that her skin itched and had become yellowish in color, and that her stools were clay-colored and her urine very dark.

Examination showed white blood cells 6,400; red blood cells, 4,800,000; hemoglobin 70 per cent; urine bile, 111; stools, no bile; Wassermann, negative; Graham Cole, very poor filling of gall bladder. Fluoroscopy of stomach and colon was negative.

The patient was placed on medical management. She re-entered the hospital May 31, 1935. Laboratory findings: Bleeding time, 15 minutes; coagulation, 3½ minutes; white blood cells, 5,850; red blood cells, 4,700,000; hemoglobin, 68 per cent.

The patient suffered with intolerable itching. On physical examination, the abdomen revealed a sharp liver margin, extending about 5 inches below the costal border. No undue tenderness or rigidity was present. The skin and sclera were icteric and the physical examination was otherwise negative.

The patient was prepared for operation with a high carbohydrate diet. A direct blood transfusion was given immediately following operation. There was marked oozing when the abdominal incision was made; every bleeding point was ligated and the abdomen opened. The liver was enlarged, smooth, copper green in color. The gall bladder was distended and contained about 120 cubic centimeters of thin, greenish bile. No stones were palpated in the gall bladder or ducts. The head of the pancreas was firm, hard, though not of a cartilaginous hardness characteristic of carcinoma. There were many small shot-like glands along the gastrohepatic ligament. The common duct was opened, the ducts were explored, and no stones were found. Because of the deep jaundice and high bleeding time, a T-tube

was sutured into place in the common duct and the abdomen was closed. The operative diagnosis was: chronic pancreatitis with a possibility of early carcinoma of the head of the pancreas.

There were no serious postoperative complications. The bile drainage was dark, thick, and averaged 355 cubic centimeters for 4 days. On the fifth day, 1,000 cubic centimeters of golden bile was collected. The average bile drainage for the next 38 days was 1,226 cubic centimeters daily.

By pushing fluids, the daily intake exceeded or equaled the combined biliary drainage and urinary output. The pigmentation of the skin and sclera was most persistent. The stools on repeated tests showed no bile. Duodenal tube drainage failed to reveal any bile in the duodenal contents. The urine became free of bile on June 11, 1935.

Lipiodol visualization of the ducts was carried out. Figure 6 shows the hepatic and common as well as the left pancreatic duct filled with lipiodol. There is no evidence of lipiodol in the intestinal tract. During this examination 20 cubic centimeters of lipiodol was used with moderate pressure. The patient complained of severe pain in the upper region of the liver and the back of the right side. This persisted until the drain tube was opened, when the pain gradually decreased as the bile drainage increased. The pulse was slow and weak and the patient became cold, clammy, and perspired.

On July 11, 1935, revisualization of the ducts showed complete blocking, and July 13, 1935, a cholecystogastrostomy was done. A further exploration of the ducts failed to reveal any stones. The pancreas at this time was distinctly indurated, but the lobules could be distinguished on palpation. Following operation, the stools became normal and the patient was discharged from the hospital on the twelfth postoperative day. She gradually regained strength and remained in very good health for about 6 months when pain in the right upper quadrant with nausea and vomiting became persistent and severe. X-ray studies showed a filling defect in the second portion of the duodenum with only partial emptying of the stomach. At exploratory operation, the head of the pancreas was found to be enlarged with a cartilaginous hardness. It practically obstructed the lumen of the duodenum. A posterior gastro-enterostomy gave the patient a brief respite from her symptoms. She died 18 months after the onset of symptoms with the usual cachectic picture one sees in carcinoma of the head of the pancreas.

Fig. 6. Lipiodol injection shows complete obstruction at the ampulla of Vater with filling of the left pancreatic duct.

The following case, in which patient was a male aged 61 years, illustrates the value of exploratory operation and bile tract visualization in elderly patients with jaundice.

CASE 3. Male, aged 61 years, entered the Presbyterian Hospital October 6, 1935, with the following history. During the past 6 weeks, the patient had developed a deepening painless jaundice with acholic stools and intolerable itching. There had been some nausea and loss of appetite, but very slight loss of weight. The patient admitted luetic infection 20 years previously for which he had had prolonged treatment. He was also a moderate drinker. There had been no recent ingestion of toxic drugs or alcoholic excesses.

The essential findings on physical examination were those of a marked jaundice in an elderly, well nourished male of 61 years. There was slight tenderness in the epigastrium. The liver was enlarged, the edges smooth and extended about 4 inches beneath the costal border. There was no evidence of ascites or edema. Temperature was 98.6 degrees; pulse, 70; red blood cells, 4,450,000; white blood cells, 12,350. Urinalysis showed bile, plus four. The icteric index was 151.8. Stools, on repeated examination, showed no bile. The Wassermann reaction was negative. X-ray studies of gastro-intestinal tract showed no demonstrable pathology. Rose Bengal test for liver function gave 37 per cent in 8 minutes and 57 per cent in 16 minutes.

Repeated duodenal intubation with injection of magnesium sulphate, 50 per cent solution, or olive oil, failed to cause biliary discharge. The patient was observed for about 2 weeks when an exploratory operation was advised. The diagnosis was probable impacted stone in the common duct or malignancy.

At operation, the liver was found to be enlarged and mahogany brown in color. The gall bladder was enlarged and distended. No stones were present in the gall bladder or ducts. The head of the pancreas was indurated. Thick, inspissated bile was aspirated from the gall bladder and a No. 28 Pezzer catheter was invaginated with two purse-string sutures. Five hundred cubic centimeters of blood was given by direct transfusion.

The postoperative course was uneventful, the daily average biliary drainage being 345 cubic centimeters. On the seventh postoperative day, bile appeared in the stools. Before patient left the hospital, the bile tract was visualized, 20 cubic centimeters of diodrast being used. A roentgenogram (Fig. 7) showed that most of the contrast fluid passed at once into the small bowel, although some was in the ducts. A second film 1 hour later showed only a small amount in the inner tip of the drain tube.

The patient was instructed to clamp the drain tube for 1 hour daily, increasing the time period an hour each day if no discomfort was experienced. When he returned

Fig. 7. Diodrast fills the ducts and passes at once into the duodenum.

December 27, 1935, the tube had been unopened for several days (Figs. 8 and 9). Lipiodol visualization was then done. The roentgenograms show the filling and emptying with lipiodol.

It is interesting to compare these films. Because of its viscosity, lipiodol is slower in emptying from the ducts, whereas diodrast empties into the small bowel at once. This fact may account for the difference in interpretation in visualization of the bile tract and should be considered when contrast media such as diodrast are used. One month after the last visualization, the drain tube was removed. The patient has remained in good health since. The finding of a chronic pancreatitis with obstruction of the common duct was noted at operation. Spasm of the sphincter of Oddi is unlikely, for repeated duodenal lavage by drugs supposed to relax a sphincter spasm failed to bring the relief that decompression of the biliary tract by drainage effected.

CASE 4. Woman, aged 45 years, entered the Presbyterian Hospital July 30, 1935, with the following history. She had had a cholecystectomy in March, 1929, at which time a diagnosis of cholelithiasis was made. A few days following operation, she complained of severe pain in the epigastrium and the right upper quadrant, which was referred to the back. She left the hospital in 15 days. Since the operation, the patient has had recurring pain at intervals accompanied by nausea, sometimes by vomiting, with occasionally dark urine and jaundice. She has never noticed whether her stools were clay colored. She has lost 20 pounds in 2 years.

Physical examination was essentially negative. There were noted the old operative scar and tenderness in the right upper quadrant. The liver and spleen were not palpable. Temperature was 98.8 degrees; pulse 96; respiration, 20; blood pressure, 126/72; hemoglobin 64 per cent; red blood cells, 3,730,000; white blood cells, 63,000; icteric index was 25.4; bleeding time 2 minutes; coagulation 3 minutes. Wassermann reaction was negative. Van den Bergh, very much delayed by the direct method.

An exploratory operation was done August 5, 1935, by Dr. W. Potts, ethylene anesthesia being used. The ducts

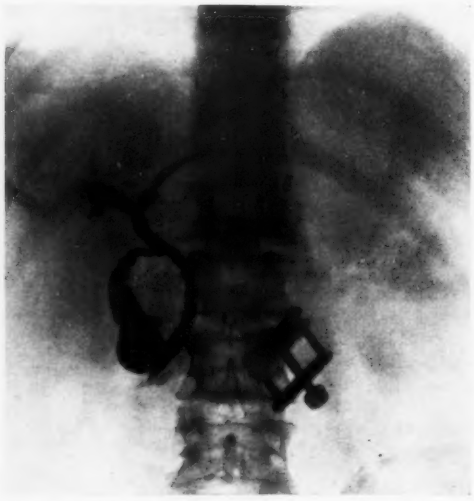


Fig. 8. Lipiodol fills the bile tract, but because of its viscosity does not at once enter the duodenum.

Fig. 9. One hour after fat meal tract is nearly free of lipiodol.

were found slightly enlarged. No stones were found, and a T-tube was inserted into the common duct. Operative diagnosis: stricture of the terminal portion of the common duct. The postoperative course was uneventful. There was a flow of golden yellow bile that averaged about 650 cubic centimeters daily. The T-tube was clamped daily for increasingly long periods, first for a 30 minute period and increasing until a 5 hour period was reached. On clamping the tube, the patient complained of pain in the right upper quadrant and back. The pain was so intense that she insisted the tube be opened. The stools have remained acholic, but the urine was bile free. On August 15, 1935, a lipiodol injection into the bile tract was done (Figs. 10 and 11). In the roentgenogram lipiodol outlines the hepatic and common ducts. There is some lipiodol in the small bowel. A film taken 1 hour later shows practically all the lipiodol in the bowel. There is a small amount of lipiodol in the hepatic ducts. The pancreatic portion of the common duct appears constricted. Lipiodol injections were repeated on September 14, 1935, and revealed a similar defect in the pancreatic portion of the duct. One hour after a fat meal the x-ray film showed only traces of the lipiodol remaining in the ducts.

Despite the fact that the lipiodol emptied from the ducts after a fat meal, closure of the drain tube for a 5 hour period caused the typical distress for which the patient entered the hospital. She was again operated upon and a choledochoduodenostomy was done. The patient left the hospital, and when last seen was entirely symptom-free.

CASE 5. Male, aged 42 years, entered the Cook County Hospital in March, 1935, with a diagnosis of catarrhal jaundice. He gave the history of loss of weight, clay colored stools, and loss of appetite and strength. He noticed that his skin was yellow-tinged and he complained of severe itching.

Fig. 10. Lipiodol injection shows a structure of the pancreatic portion of the common duct.

Physical examination was essentially negative, except for right upper quadrant tenderness and the presence of jaundice. He remained in the hospital for a short time, and when he left the jaundice had disappeared, and he felt perfectly well.

On August 24, 1935, he returned to the hospital complaining of severe oppressive pain in the epigastrium and lower chest which encircled the body. It was so severe that morphine did not give relief, and because a coronary thrombosis was suspected, he was given nitroglycerin 1/100 grain hypodermically which treatment gave him instant relief.

Physical examination revealed jaundice of the sclera and skin; slight tenderness in the right upper quadrant of the abdomen. The other findings were essentially negative. Temperature was 98 degrees; pulse 86. Examination showed that the stools and stomach content were normal. Wassermann reaction was negative; Graham Cole showed no filling. Icteric index was 37. Patient was prepared for operation. Eight hundred cubic centimeters of 25 per cent dextrose solution was given for several days, and he was transferred to surgery.

At operation September 2, 1935, the gall bladder was found contracted. No stones could be felt in the gall bladder, hepatic, or common ducts. The head of the pancreas was firm, hard and indiscrete. No nodules could be felt. The ducts were explored and a T-tube was sutured in the common duct.

The postoperative course was uneventful. He was given dextrose solution 10 to 25 per cent intravenously for 3 or 4 days. The T-tube was clamped after the third day. The average drainage through the T-tube was 200 cubic centimeters daily.

On September 24, 1935, lipiodol injection of the gall tract showed that common and hepatic ducts were outlined with a slight amount of lipiodol in the first portion of the duodenum. One hour after a fatty meal, the ducts were entirely free of lipiodol. The T-tube was removed some weeks later.

Fig. 11. One hour after fat meal lipiodol has passed into the small bowel.

Fig. 12. Lipiodol fills the bile tracts and passes into the duodenum.

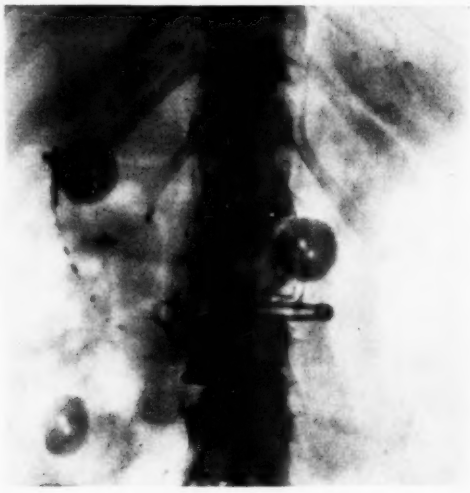


Fig. 13. Bile tracts free of lipiodol after fat meal. No obstruction in ducts.

The probable diagnosis in this case was common duct stone, which may have been passed when the patient was admitted the second time to the hospital, at which time he suffered such severe pain. That there was an associated pancreatitis was evidenced at operation. The lipiodol injection does not show that the induration is now present and the T-tube was removed some weeks later.

CASE 6. Female, aged 67 years, was admitted to the hospital with a history of recurring attacks of pain and discomfort in the right upper quadrant of 30 years' duration. This last attack had been more severe than any preceding one, being accompanied by chills, fever, nausea and vomiting, as well as by severe pain. She stated that she had been jaundiced at times, but the jaundice had always subsided. This time, however, the jaundice had persisted.

The patient was a well nourished female of apparent age, with slight icteric tinge to the sclera. She appeared acutely ill.

The physical findings were essentially normal with the following exceptions. There was marked rigidity and tenderness in the region of the gall bladder, and a slight abdominal distention. Temperature was 100.6 degrees; pulse, 90; white blood cells, 24,000. Urine was negative on analysis. The patient had been acutely ill for several days before admission. She was treated conservatively for a few days, there being no subsidence of symptoms, and on leucocytic increase, operation was advised with the diagnosis of acute cholecystitis with stone. At operation, a small perforation at the fundus of the gall bladder was found. The gall bladder contained many stones. An impacted stone was dislodged from the cystic duct. No stones could be felt in the hepatic or common duct or ampulla of Vater. The right hepatic, cystic, and common ducts were thick and indurated. The head of the pancreas felt normal. A No. 20 Pezzer catheter was invaginated into the gall bladder for drainage. The patient made an uneventful recovery.

The tract was later visualized so that residual stones might not be overlooked (Figs. 12 and 13). Bile was allowed to drain for several weeks following operation, so that the infection in the ducts could be relieved. The tube was then clamped at intervals as described, and removed 3 months after operation. The patient has continued in good health since operation.

CONCLUSIONS

1. Visualization of the bile tracts at operation may be decidedly helpful in the finding of unsuspected causes of obstruction such as stricture, stone, and extraductal or intraductal pressure. It may reduce operative time by showing that no obstruction is present.

2. Visualization in cases of drainage, may be helpful in showing that the bile tract is unobstructed, or that induration of the biliary tract is still present, and that continued drainage is advisable.

3. Visualization using varying types of contrast media may be helpful in a study of the sphincter mechanism of the biliary tract.

4. Early decision that the lesion is an operative one is essential so that patients who, because of their age and condition, may be given the benefit of prompt surgery. This is important because of the difficulty in distinguishing between malignant and non-malignant obstruction.

5. Active measures to combat the effect of

jaundice are those that seek to repair the damage to the liver, the blood, and other organs. The giving of glucose intravenously or by mouth, the use of calcium salts such as calcium, gluconate, and finally repeated blood transfusions, are important.

6. Relief of the jaundice with minimum trauma to the patient is essential. Cholecystotomy or common duct drainage with removal of the offending cause at a subsequent period may be a factor in reducing operative mortality. If the patient's condition permits, direct visualization of the bile tracts may make a second operation unnecessary.

7. Postoperative maintenance of fluid balance and blood chlorides is essential to compensate for the loss by external biliary drainage.

8. Control of biliary drainage by the use of a soft, pliable T-tube or a Pezzer catheter prevents too rapid hepatic decompression, and also is a factor in preventing fluid loss.

BIBLIOGRAPHY

1. HICKEN, N. F., BEST, R. R., and HUNT, H. B. Cholangiography: visualization of the gall bladder and bile ducts during and after operation. Ann. Surg., 1936, 103: 210–229.
2. IVY, A. C. Physiology of the gall bladder. Physiol. Rev., 1934, 14: 1–102.
3. MELTZER, S. J. Diseases of the bile ducts and gallbladder. Am. J. M. Sc., 1917, 153: 469.
4. MIRIZZI, P. L. Cholangiografi durante las operaciones de las vias biliares. Bol. y. trab. Soc. de cirug. de Buenos Aires, 1932, 16: 1133–1161.
5. NEWMAN, C. Physiology of gall bladder and its functional abnormalities. Lancet, 1933, 1: 785–841, 896.
6. RAVDIN, I. S., JOHNSTON, C. G., RIEGEL, C., and WRIGHT, S. L., JR. Am. J. Physiol., 1932, 100: 317.
7. THORLAKSON, P. H. I., and MCMILLAN, J. C. Common duct obstruction: lipiodol studies of cholangiectasia showing effects of prolonged drainage. Canadian M. Ass. J., 1934, 31: 269.
8. WHITAKER, R. The mechanism of the gall bladder. Am. J. Physiol., 1926, 78: 411. Experiences with cholecystography including observations on functions of gall bladder. J. Am. M. Ass., 1926, 86: 239–243.

ADDITIONAL ADVANTAGES OF THE HAWLEY TABLE

GEORGE W. HAWLEY, M.D., F.A.C.S., Bridgeport, Connecticut

FRACTURES of the spine have been on the increase during the past few years. Automobile accidents chiefly account for this increase. Forced flexion of the spine results in compression fracture. This may be the sole injury.

Improvement in roentgenographic technique, especially the perfection of lateral graphs, has made it possible to detect these fractures with greater accuracy and certainty. The element of error has been reduced and fewer fractures are overlooked.

The introduction of hyperextension in the treatment of these fractures has been a step forward. This method usually results in reduction of the fracture deformity, even when there is an associated dislocation.

From the Orthopedic and Fracture Service of the Bridgeport Hospital

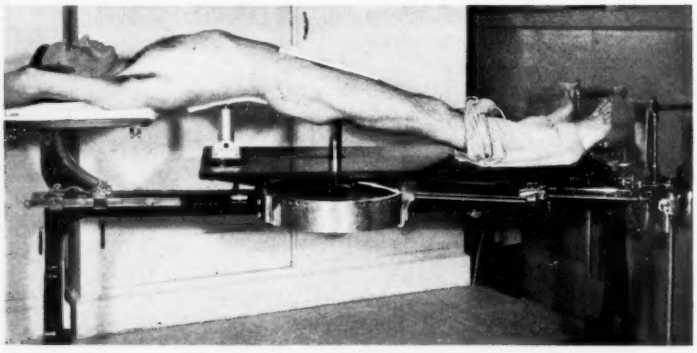


Fig. 1.

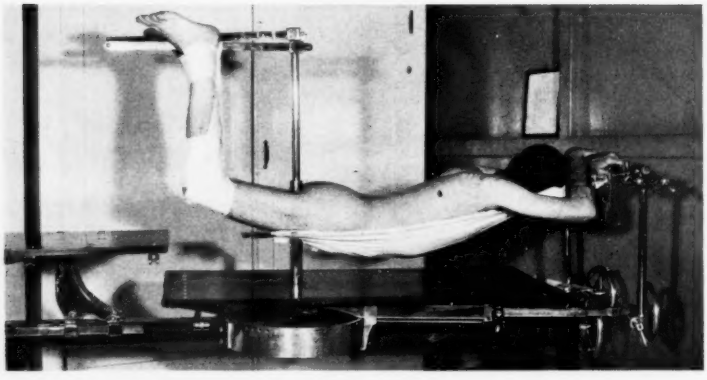


Fig. 2.

Fig. 1, above. Hyperextension of spine by direct application of force. An automobile jack is used to exert pressure at the point of fracture. This is a direct method of hyperextension in contrast to indirect, physiological, or postural hyperextension.

Fig. 2. Hyperextension of spine by posture. Ventral position with legs suspended and thighs extended on pelvis. Head can be raised by elevating foot pieces at end of leg bars. Patient exposed for roentgenography and application of plaster.

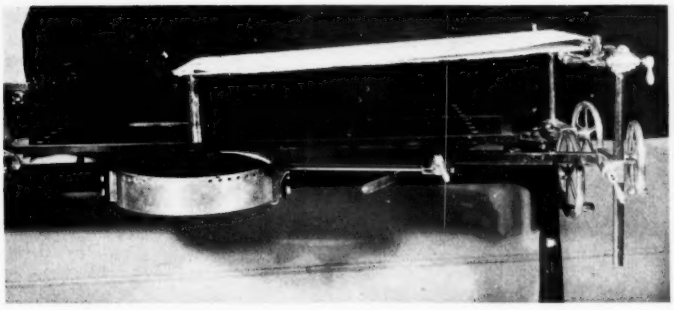


Fig. 3.

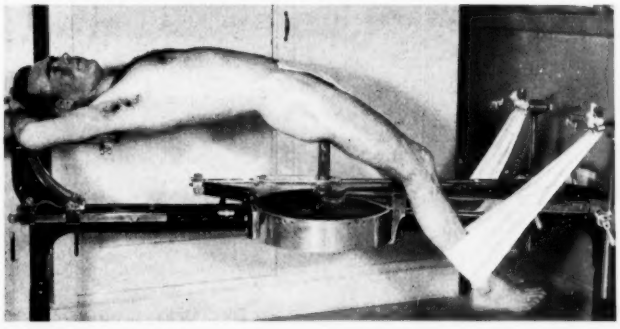


Fig. 4.

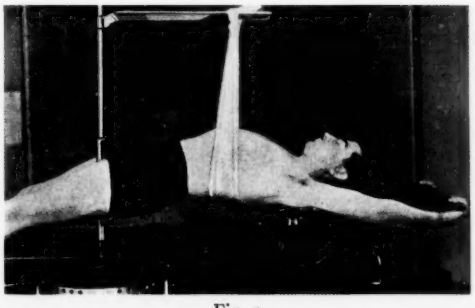


Fig. 5.

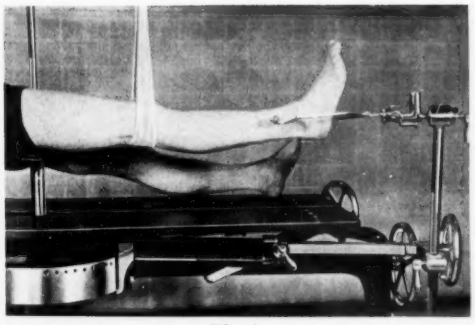


Fig. 6.

Fig. 3. Hammock for ventral suspension. Several layers of a 5-inch muslin bandage are wound between the central cross bar and the bar resting on foot pieces. The hammock is made taut by extending leg bars. After hammock is in place the table top is raised, the patient is placed on the table and is suspended as in Figure 2.

Fig. 4. Physiological hyperextension of lumbodorsal spine. (Site of many compression fractures). Dorsal position. The lower section of the table top is removed. The thighs and legs are then extended. In the dorsal position it is possible to examine, roentgenograph, hyperextend, and immobilize without moving patient. Increased hyperextension is secured by using the sling as shown in Figure 5.

Fig. 5. Hyperextension by sling. Several thicknesses (to give strength and prevent wrinkling) of muslin bandage are used with a pad of felt. The sling can be used in combination with extension of the legs as shown in Figure 4.

Fig. 6. Traction on tibia using Kirschner wire or Steinmann pin through the lower end of the tibia or os calcis. Wire is introduced and a loop is applied with the table top raised and the leg resting on the table. The method is effective in the reduction of fresh fractures and immobilization in plaster. Roentgenologic control is convenient. The method is useful in open reductions to obtain traction during operation.

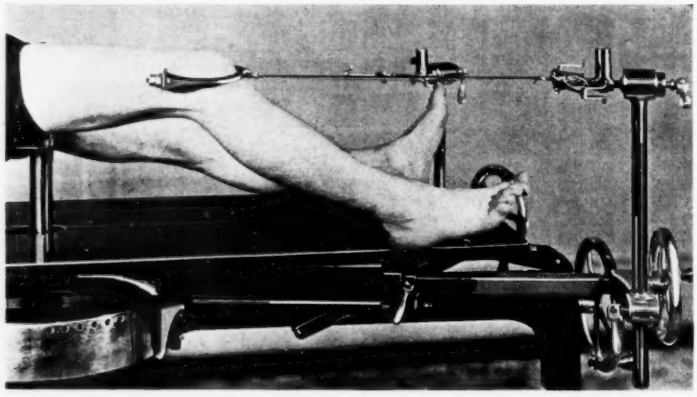


Fig. 7.

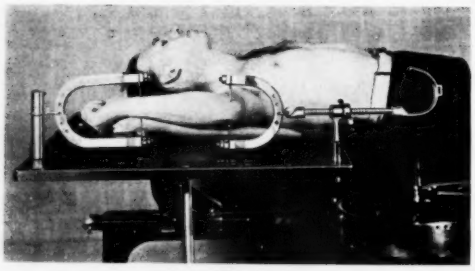


Fig. 8.

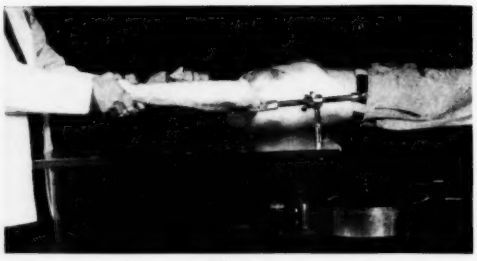


Fig. 9.

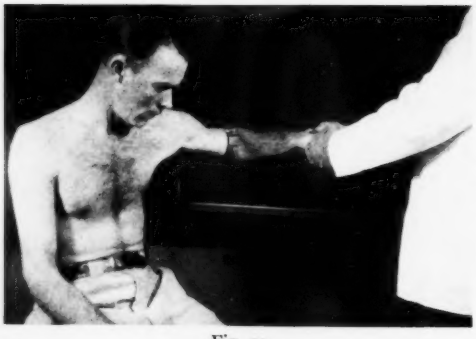


Fig. 10.

Fig. 7. Skeletal traction on femur.
Fig. 8. Skeletal traction on forearm. Two wires are used: one for traction and one for countertraction. The distal wire is placed 1 inch from the end of the radius external to the radial vessels and other wire is placed 1¼ inches from the tip of the olecranon. Both wires are slightly off center and on different bones, but experience shows that the method is effective in the reduction of fractures of one or both bones.

Fig. 9. Suspension of the forearm and elbow with manual traction. Patient is placed on the table. The elbow hook provides a firm point of countertraction. The arm is free for examination, manipulation, roentgenological examination by fluoroscope or graph. The method is effective in elbow fractures and dislocations, in fractures and dislocations of the head of the radius, in fractures of the radius and ulna, in Colles' fractures where it is possible to combine strong traction with manipulation and leverage at the point of fracture, and in dislocations of the semilunar.

Fig. 10. Control and suspension of the forearm with patient sitting by the table. This method is useful in subjects suitable for reduction under local anesthesia.

Figures 1 to 5 depict the various ways of securing hyperextension on the fracture table.

SKELETAL TRACTION

Skeletal traction has become a standard method of fracture treatment. It is in general use, especially since the introduction of the Kirschner wire and tension loop. Figures 6 to 8 are three photographs showing skeletal traction as applied to the tibia, to the femur, and to the bones of the forearm. In the first two, the wires are introduced with the table top up and the perineal post used

for countertraction. The limb is exposed for physical examination, manipulation, and roentgenologic examination by fluoroscope or graph. After reduction, the table top is lowered for immobilization in plaster.

Figures 9 and 10 show suspension and manual traction in the treatment of fractures of the elbow and bones of the forearm. The elbow hook makes a point of strong countertraction. Experience has shown that strong traction is readily borne without the use of padding. This method is practical and effective in the treatment of diacondylar fractures of the humerus, dislocations of the elbow, dislocations and fractures of the head of the radius, fractures of shaft of radius and ulna, and Colles' fractures, where it is possible to combine strong traction with manipulation and leverage at the point of fracture. The arm is exposed for roentgenological examination before, during, and after the treatment, and is in position for plaster encasement after reduction has been effected.

THE "HANGING CAST" IN THE TREATMENT OF FRACTURES OF THE HUMERUS

A. D. LAFERTÉ, M.D., F.A.C.S., and M. G. ROSENBAUM, M.D., Detroit, Michigan

THE "hanging cast" is a plaster cast applied from the axilla to wrist with the elbow flexed to a right angle; a sling suspends the cast from the neck. It was first suggested by Dr. J. A. Caldwell in 1933, for some fractures of the shaft of the humerus. We have used the "hanging cast" extensively in fractures of the shaft and of the neck of the humerus. It is our purpose to report roentgenographic and clinical results obtained in 58 cases in which patients were treated at Receiving Hospital during the year beginning November 23, 1935, and ending November 23, 1936, and to discuss the advantages and disadvantages of this method.

The treatment of fractures of the humerus in adduction has been debated considerably. Various authors (2, 3, 4, 5, 6, 7) suggest different methods, but none offers case reports so that no comparison of results is permitted. We hope that our data will be of value in answering this question.

Not all fractures of the humerus were considered suitable for treatment with the "hanging cast"; badly comminuted fractures of the head and fractures involving the condyles or the supracondylar area were treated by other methods.

The patients whose histories are reported in this paper were observed from the time of injury until discharged from the clinic with healed fractures. All cases in which patients were so observed are reported so that poor as well as satisfactory results are presented. A number of cases in which progress was satisfactory are omitted from this report because the patients did not return for final examination.

From the Department of Bone and Joint Surgery, City of Detroit Receiving Hospital, Wayne University Medical College.

We have used the following classification based upon the x-ray findings in the fracture when first seen.

1. Fractures of the upper-third of the humerus: (a) in good or fair position, (b) in poor position.

2. Fractures of the middle and lower thirds of the shaft of the humerus: (a) in good or fair position, (b) in poor position.

Twenty-three fractures were in the upper-third of the humerus in good or fair position. The cast was applied following x-ray examination with the patient either sitting or recumbent; the injured arm was abducted carefully and the elbow flexed, while plaster was applied extending from the axilla to the wrist, not including the wrist joint. Three rolls of plaster, 6 yards long by 6 inches wide were used for adults; the cast weighed about 2 pounds when dry. A plaster loop was incorporated at the wrist to permit suspension from the neck. The cast was trimmed at the axilla and wrist so that motion would cause no discomfort. Passive motion at the shoulder was then employed whereby the patient leaned forward and let the arm swing; later, active motion was urged. Active motion of the wrist was encouraged from the beginning. Following application of the cast, the position of the fragments was deter-

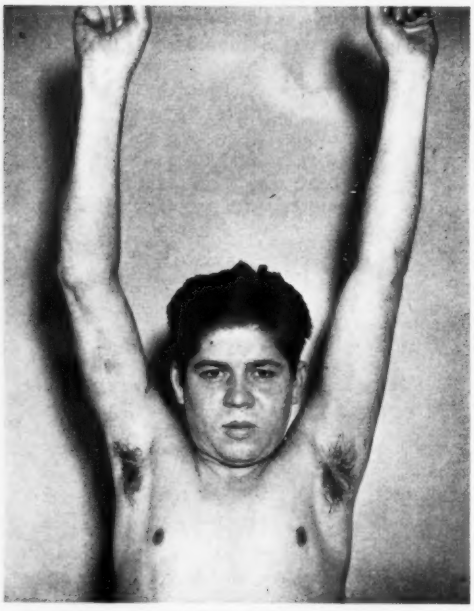


Fig. 1. Case 42 (Table III). One week after removal of hanging cast and 5 weeks after transverse fracture of middle third of humerus.

mined by x-ray examination. The progress of the patient was observed at 2 week intervals.

In this group the age varied from 5 to 86 years. Practically as many transverse as oblique fractures occurred. The cast was applied soon after the accident, although this was delayed when the general condition of the patient was poor (Cases 2 and 3). In 9 cases (7, 8, 13, 14, 18, 19, 21, 22, 23) the patient was not hospitalized. The cast was removed after periods varying from 3 to 9 weeks, depending upon clinical and roentgenographic findings. It is interesting to note that there was no slipping of the fragments except in Cases 2, 9 and 10, where definite improvement in position occurred. We do not believe that this method should be used to correct a displacement; only fractures in good or fair position should be so treated. Displacement should be corrected by manipulation or operation.

While the consistently satisfactory roentgenographical results are important, yet the early and unusually good function of the shoulder is the outstanding feature of the method (Fig. 1). Upon removal of the cast or upon the discontinuance of physiotherapy, as shown in Table I, a shoulder which functioned almost as well as

Fig. 2. Abduction wedge on inner side of cast to prevent lateral angulation.

before injury was termed "excellent." The ability to abduct the arm to 90 degrees, with only slight limitation of external rotation was considered "good," a less degree of function was termed "fair." Slight motion was termed "poor." We have observed that a shoulder which was not permitted motion for a period of 6 or 8 weeks would have marked limitation of motion and muscular atrophy; function returned but partially with extended physiotherapy.

If in the use of the "hanging cast" a patient is encountered who would not do the bending exercises as advised, it would seem to us that a cast which held the arm in abduction would be preferable, as physiotherapy would probably restore motion at an earlier date. Treatment with the "hanging cast" does not immobilize the fracture site; it does offer the patient the opportunity to restore the shoulder to as near normal function as possible. We emphasize this point, because some patients do not understand, or are afraid to follow directions. These patients must be seen at frequent intervals for examination and encouragement. In this group, 3 cases (9, 10, and 14) required extensive physiotherapy to the shoulder; the rest carried out exercises at home. Little difficulty was experienced because of immobilization of the elbow; residual stiffness disappeared with moderate use. Atrophy of muscle and bone from disuse was almost avoided.

The appearance of the shoulder in this series was normal. Union occurred without delay. No complications were observed.

Ten fractures were in the upper third of the humerus and were variously displaced. Two

TABLE I.—FRACTURE OF THE UPPER THIRD OF THE HUMERUS INCLUDING THE SURGICAL NECK IN GOOD OR FAIR POSITION

Case	Age	Type of fracture	Date of injury	Cast applied	Number of weeks in cast	Final x-ray	Physiotherapy	Function of shoulder
1. Mrs. H. B.	57	Irregular, transverse	11-23-35	11-25-35	8	Excellent	No	Excellent
2. Mr. A. L.	76	Spiral, oblique	12- 2-35	12- 6-35	5	Excellent	No	Excellent
3. Mr. T. W.	55	Transverse	12- 4-35	12-10-35	7	Excellent	No	Good
4. Mrs. L. R.	46	Transverse	12- 4-35	12- 5-35	5	Excellent	For 2 Wks.	Excellent
5. Mrs. C. M.	86	Oblique	12-24-35	12-26-35	4	Excellent	No	Excellent
6. Mrs. M. M.	59	Oblique	1- 8-36	1- 9-36	9	Excellent	No	Excellent
7. Mrs. M. M.	72	Oblique	1-20-36	1-20-36	8	Excellent	No	Good
8. Mr. L. M.	58	Spiral, oblique	1-30-36	1-30-36	4	Good	No	Excellent
9. Mrs. M. E.	67	Irregular, transverse	2- 4-36	2- 5-36	8	Excellent	For 3 mos.	Good
10. Mrs. I. T.	68	Oblique	2- 4-36	2- 5-36	4	Excellent	For 4 wks.	Excellent
11. Mrs. R. S.	38	Oblique; in partial apposition	4- 6-36	4- 7-36	8	Good	No	Excellent
12. Mr. P. B.	37	Oblique	4-20-36	4-21-36	7	Good	No	Good
13. Miss M. C.	12	Transverse	6- 1-36	6- 1-36	3	Excellent	No	Normal
14. Mr. O. G.	62	Transverse	6- 8-36	6- 8-36	6	Excellent	For 8 wks.	Fair
15. Mrs. L. B.	31	Transverse	6-10-36	6-12-36	7	Excellent	No	Excellent
16. Mr. E. P.	44	Oblique comminuted	6-11-36	6-12-36	4	Excellent	No	Normal
17. Miss E. C.	25	Transverse	6-15-36	6-16-36	5	Excellent	No	Excellent
18. Mr. G. C.	13	Oblique	7-18-36	7-18-36	5	Excellent	No	Excellent
19. Miss D. S.	14	Transverse	8-27-36	8-27-36	4	Excellent	No	Excellent
20. Mr. B. H.	65	Oblique	9- 3-36	9- 4-36	7	Excellent	No	Good
21. Mr. S. A.	5	Oblique	9-10-36	9-10-36	4	Excellent	No	Normal
22. Mr. E. D.	65	Transverse	9-14-36	9-14-36	5	Excellent	No	Excellent
23. Mrs. T. K.	74	Transverse	10-15-36	10-15-36	6	Excellent	For 3 wks.	Good

children suffered displacement of the shaft laterally to the neck; 8 adults suffered displacement of the shaft medially with overriding of the fragments in all but 2 cases.

Early manipulation under deep anesthesia was first attempted. With the patient recumbent on the fluoroscopic table, strong force was applied to the arm in two directions: first, by traction with a flannel band passing around the flexed elbow of the patient and around the operator's waist, and, second, by pressure exerted at the fracture site at right angles to the shaft, to correct the medial or lateral displacement. Countertraction was obtained by a sheet around the thorax. Spasm of the pectoral muscles was overcome with difficulty usually; a reduction of the displacement could often be seen externally. The "hanging cast" was applied when a good reduction was evident in the fluoroscope. Roentgenograms were taken the next day and at 2 week intervals. Satisfactory reductions were obtained by manipulation in 5 cases.

In 2 cases (24 and 29) in which manipulation failed, traction by means of a Kirschner wire through the olecranon was used. No improvement was obtained. Open reduction was the final treatment.

It is our belief that open reduction is indicated when manipulation fails. In one case (1) an airplane spica was applied for 3 weeks following operation, and then replaced by a "hanging cast." In 3 cases (28, 29, and 33) the "hanging cast" was applied following operation. No fixation of the fragments was used other than the interlocking of edges; yet the fragments maintained their positions. Perhaps the most conservative procedure when displacement is corrected by operation is to immobilize the shoulder for a 3 week period, and then to start motion with the "hanging cast."

TABLE II.—FRACTURE OF THE UPPER THIRD OF THE HUMERUS INCLUDING THE SURGICAL NECK IN POOR POSITION

Case	Age	Date of injury	Type of displacement	Corrective procedure	Number of weeks in cast	Final x-ray	Physio-therapy	Function of shoulder
24. Mr. S. B.	31	11–24–35	Shaft medial to head with 1½ inches overriding	Manipulation and skeletal traction unsuccessful; open reduction with airplane spica; hanging cast applied after 3 weeks	5	Excellent	For 2 mos.	Normal
25. Mr. F. J.	49	12–23–35	Shaft medial to head with 1¼ inches overriding	Manipulation; hanging cast	8	Excellent	For 3 mos.	Fair
26. Mr. P. G.	3	5– 7–36	Shaft lateral to neck with 1 inch overriding	Manipulation unsuccessful; other correction refused. Hanging cast	3	Poor	No	Excellent
27. Mrs. E. D.	69	7–14–36	Shaft medial to neck with ½ inch overriding	Manipulation and hanging cast	6	Good	For 4 mos.	Good
28. Miss A. J.	32	7–15–36	Oblique fracture with ½ inch overriding	Manipulation unsuccessful; open reduction and hanging cast	4	Excellent	No	Excellent
29. Miss P. C.	7	7–22–36	Shaft lateral to neck with ¼ inch overriding	Manipulation and skeletal traction unsuccessful; open reduction and hanging cast	5	Excellent	No	Normal
30. Mr. G. K.	65	8 –6–36	Comminution of neck with ¾ inch overriding	Manipulation, delayed 14 days; hanging cast	6	Good	For 1 mo.	Good
31. Mr. F. W.	77	8– 6–36	Shaft medial to head with 1 inch overriding	Manipulation; hanging cast	7	Excellent	For 3 mos.	Fair
32. Mr. H. L.	35	8–10–36	Shaft medial to head with ½ inch overriding	Manipulation; hanging cast	8	Excellent	For 2 wks.	Good
33. Mr. K. P.	27	8–29–36	Shaft displaced inward	Manipulation unsuccessful; open reduction and hanging cast	6	Good	For 2 mos.	Fair

Case 26 is of interest. The child had lateral displacement of the shaft with overriding of 1 inch. Manipulation under anesthesia failed. The parents refused permission for hospitalization or operation. A "hanging cast" was applied for 3 weeks; solid union occurred with no improvement in the position of the fragments. The shoulder function was normal; some deformity was evident. The roentgenographical result was unsatisfactory.

Union occurred in all without delay, the cast being removed after periods varying from 3 to 8 weeks. The appearance of the shoulders was normal. No vascular or neurological complications occurred. In Case 31 the patient suffered a contracture of the fingers despite satisfactory function in the wrist, elbow, and shoulder. More physiotherapy was required in these cases than in the undisplaced fractures (Table II).

A review of 33 fractures of the surgical neck of the humerus shows that good results, both anatomical and functional, can be obtained by the "hanging cast." Long periods of hospitalization in a recumbent position are avoided; airplane splints and spicas are avoided. The advantages to the aged are many. Manipulation offers better results than traction in the correction of displacements. To the co-operating patient the "hanging cast" presents an opportunity to obtain a good functional result; the patient, however, must be closely supervised. Simplification of treatment of these fractures is not without its hazards. Most patients will not carry out active motion unless constantly encouraged. The fact that the fracture site is not immobilized presents an obvious target for criticism; but in the series here reported, no case suffered delayed union or non-union.

Sixteen fractures involved the middle or lower third of the shaft and were in good alinement and partial or total apposition. Ten were transverse fractures of the middle third of the shaft. Three fractures were comminuted and irregular; 2 were through the thinned walls of bone cysts. All but 2 occurred in adults.

In this type of fracture, the chief problem was to maintain good apposition and alinement while applying the cast and during the convalescent period. When the cast was applied many of these fractures would slip out of position unless the elbow was maintained in acute flexion. If acute flexion made the application of the circular cast impossible, a posterior plaster splint was applied and the cast was then completed. Moderate traction at the elbow usually sufficed to hold the fragments during the application of the plaster. No anesthetic was used in these fractures. Fluoroscopic and roentgenographical examinations were

TABLE III.—FRACTURES OF THE MIDDLE AND LOWER THIRD OF THE HUMERUS IN GOOD OR FAIR POSITION

Case	Age	Type of fracture	Date of injury	Cast applied	Number of weeks in cast	Final x-ray	Physio-therapy	Function of elbow and shoulder	Cosmetic result
34. Miss E. B.	32	Oblique in lower third	11-30-35	12- 2-35	9	Excellent	For 1 wk.	Normal	Excellent
35. Mrs. C. M.	38	Transverse, middle third	12- 1-35	12- 2-35	8	Excellent	For 2 mos.	Normal	Excellent
36. Mrs. C. E.	78	Transverse, middle third	12-18-35	12-20-35	8	Excellent	No	Normal	Excellent
37. Mr. L. M.	52	Transverse, middle third	12-19-35	12-21-35	8	Excellent	No	Normal	Excellent
38. Mr. A. S.	32	Bullet fracture, middle third	1- 1-36	1- 5-36	7	Slight lateral bowing	No	Excellent	Excellent
39. Mr. J. M.	55	Transverse, middle third	1-17-36	1-19-36	8	Slight lateral bowing	For 3 wks.	Normal	Excellent
40. Mrs. L. K.	40	Transverse, middle third	2-19-36	2-20-36	8	Excellent	For 2 wks.	Normal	Excellent
41. Mr. O. O.	57	Lower third, refracture of bone cyst	2-25-36	2-26-36	8	Anterior bowing	No	Normal	Good
42. Mr. W. M.	18	Transverse, middle third	4-30-36	4-31-36	4	Excellent	No	Normal	Excellent
43. Mr. G. H.	45	Comminution with marked separation, middle third	6- 6-36	6- 7-36	5	Poor	No	Normal	Good
44. Miss M. B.	25	Transverse, middle third	8- 6-36	8- 7-36	5	Excellent	No	Normal	Excellent
45. Mr. L. I.	16	Transverse, middle third	8- 7-36	8- 8-36	4	Excellent	No	Normal	Excellent
46. Mr. J. K.	62	Transverse, middle third	8-10-36	8-11-36	6	Good	No	Normal	Good
47. Mrs. M. M.	28	Lower third, oblique, comminuted	9-12-36	9-13-36	9	Slight lateral bowing	For 2 wks.	Normal	Excellent
48. Mr. A. U.	7	Oblique, through a large cyst in middle third	9-18-36	9-19-36	3	Excellent	No	Normal	Excellent
49. Mr. A. M.	35	Irregular, transverse, middle third	10-28-36	10-28-36	4	Excellent	For 3 wks.	Good	Excellent

used to determine the position of the fragments in the cast.

A number of patients who had had casts applied, especially those with acute flexion of the elbow, were observed daily during the first week for swelling and cyanosis of the hand. If these symptoms appeared, they were relieved by splitting the cast. Patients were then observed at 2 week intervals, and the position of the fragments was determined by x-ray examination. Casts were applied for periods varying from 3 to 9 weeks.

Anatomical results were satisfactory in all cases except one badly comminuted fracture (Case 43). Two types of deformity, lateral bowing and anterior bowing, occurred frequently. The former occurred more commonly in fractures of the middle third and a combination of the two in fractures of the lower third. Lateral bowing occurred when the proximal fragment was displaced laterally, usually because of a large breast or a barrel shaped chest. Lateral bowing was readily corrected by the application of a small wedge to the cast at the inner side of the elbow (Fig. 2). Anterior bowing was incurred when the forearm was permitted to drop; this was corrected by shortening the wrist neck sling. Even when the humerus was in excellent position in the cast, it was necessary to observe the patient at 1 or 2 week intervals because of a common tendency to remove or lengthen the wrist neck sling and thus permit anterior bowing. Even intelligent patients required watching. Early active motion was encouraged in the shoulder, wrist, and hand.

Functional results were excellent in all cases, a normal shoulder and elbow being obtained.

In any discussion of the results of treatment of a fracture of the shaft of the humerus, the cosmetic result must be considered as seriously as the anatomical or functional result. In heavily muscled arms, deformity due to excess callus, angulation, or poor apposition, may be well concealed. However, children and most adults usually have such thin biceps, brachialis and triceps muscles, that any asymmetry or prominence at the fracture site is easily seen. The appearance of an extremity is the first concern of the patient when the cast is removed; often it is the most important one. Perhaps no factor will cause the patient to seek the services of another doctor,

TABLE IV.—FRACTURES OF THE MIDDLE AND LOWER THIRD OF THE SHAFT OF THE HUMERUS IN POOR POSITION

Case	Age	Date of injury	Type of fracture	Corrective procedure	Number of weeks in cast	Final x-ray	Physio-therapy	Function of elbow and shoulder	Cosmetic result
50. Mr. T. P.	70	12-15-35	Transverse; 1 inch overriding	Manipulation with local anesthetic; hanging cast	8	Excellent	No	Normal	Normal
51. Mrs. J. M.	38	2-15-36	Transverse; 1 inch linear separation	Two manipulations under general anesthesia; hanging cast	8	Lower fragment displaced anterior-ly	No	Normal	Good
52. Mrs. J. D.	32	2-25-36	Transverse; 1 inch overriding	Manipulation without anesthesia; hanging cast	8	Lower fragment anterior	No	Normal	Good
53. Mr. H. J.	35	3-24-36	Transverse; 1½ inches overriding	Manipulation without anesthesia; hanging cast	8	Good	No	Normal	Excellent
54. Mr. A. S.	46	4-29-36	Oblique, ½ inch over-riding with lateral angulation	Manipulation without anesthesia; hanging cast	5	Good	No	Normal	Excellent
55. Mrs. M. C.	59	7-11-36	Oblique; 1 inch lateral separation	Open reduction; hanging cast	6	Anterior angula-tion. Excessive callus	For 1 mo.	Excellent	Fair
56. Mrs. B. H.	26	7-20-36	Spiral, oblique, with anterior angulation	Manipulation without anesthesia; hanging cast	6	Excellent	For 1 mo.	Normal	Excellent
57. Mr. W. M	25	8-18-36	Spiral, oblique, in partial apposition	Manipulation without anesthesia; hanging cast	6	Excellent	No	Normal	Excellent
58. Mr. D. C.	13	8-18-36	Transverse with ¼ inch overriding	Manipulation without anesthesia; hanging cast	6	Slight lateral angula-tion	No	Normal	Fair

and perhaps of a lawyer, as readily as a deformed extremity following a fracture. We have, therefore, included a description of the cosmetic result obtained in the cases herein reported. Two cases will be discussed to illustrate the importance of this factor. Normal appearance of the arm was obtained in 13 cases; slight bowing or excess callus gave a less satisfactory appearance in 3 cases (41, 43, and 46). A good cosmetic result despite a poor roentgenographical appearance was obtained in Case 43, because of heavy muscles; the patient was well pleased. A young lady with a transverse fracture of the mid-shaft was observed for a 12 week period before much callus appeared. Becoming overconfident, she dispensed with the wrist neck sling despite frequent and careful warnings. Obvious anterior bowing was incurred; our offer to correct the deformity under anesthesia resulted in the patient leaving the clinic. Had the simple instructions been followed, an excellent result would have been obtained. Frequent supervision is necessary for this type of patient.

One patient (Case 44) had a radial nerve paralysis, despite an excellent reduction of the fracture. No other complication was observed.

Union occurred in all; a surprisingly short time was required in most cases for good callus and partial union. Physiotherapy was given a few patients for short periods (Table III).

Nine fractures involving the shaft were displaced; overriding, angulation, poor apposition, linear and lateral separation, occurred in this group. All but one fracture occurred in adults.

At first, manipulations were carried out under general or local anesthesia; our experience has been that fractures of the shaft can usually be manipulated with no anesthetic, if the patient has the least desire to co-operate. Indeed, in one patient (Case 35) a distraction of 1 inch was obtained by manipulation under anesthesia. Six fractures were manipulated without anesthesia. One open reduction was performed.

Manipulations were carried out with the patient on a fluoroscopic table. A flannel band passed through the flexed elbow and about the body of an assistant facilitated careful traction. Plaster was applied to the fracture site and to the forearm when the fluoroscopic examination showed a good reduction. Marked flexion of the elbow was necessary to maintain reduction in transverse fractures of the lower third of the shaft. Following x-ray examination, the patient was observed at 2 week intervals. Casts were applied for periods varying from 5 to 8 weeks.

Anatomical results varied. One patient (Case 58) obtained a less satisfactory result because of her refusal to return for examinations. Cosmetic results were satisfactory.

Union occurred in all cases. Little physiotherapy was required. There were no complications in this group.

This warning may be repeated; lateral bowing and anterior bowing are two deformities most to be avoided (Table IV).

SUMMARY

1. The use of the "hanging cast" has been found efficient in the treatment of most fractures of the humerus.

2. A report is presented on the results of treatment by use of the "hanging cast" in 58 consecutive cases in 1 year, of fractures of the neck and shaft of the humerus.

3. Badly comminuted fractures of the head and fractures including the condyles or the supracondylar area are not considered suitable for this method of treatment.

4. The reduction of displaced fractures is accomplished before application of the cast.

5. An interpretation is given of the terms "excellent," "good," "fair," and "poor" used in this discussion. The fractures are grouped according to location.

6. No attempt is made to immobilize the fracture site, notwithstanding which there have been no cases of delayed or non-union.

7. Twenty-three fractures of the upper third of the shaft and of the neck are described and the satisfactory results noted.

8. Twenty-five fractures of the lower two-thirds of the humerus were treated by the use of the "hanging cast" with satisfactory results.

9. The application of a plaster wedge to the inner side of the cast in certain individuals prevents lateral angulation.

10. In caring for a fractured humerus in a non-co-operating patient some other form of treatment is advised.

11. Early motion at the shoulder and wrist are insisted upon and results in nearly normal joint motion and muscle development upon removal of the cast.

12. Following removal of the cast, physiotherapy was used in but 20 of the 58 cases. This was found to be most consistently indicated in fractures occurring at or near the surgical neck of the humerus, in which there had been marked displacement of the fragments at the time of fracture.

13. The use of the "hanging cast" reduces hospitalization to a minimum.

BIBLIOGRAPHY

1. CALDWELL, JOHN A. Ann. Surg., 1933, 97: 161.
2. FUNSTEN, ROBERT V., and KINSER, PRENTICE. J. Bone & Joint Surg., 1936, 18: 191.
3. HOWARD, N. J., and ELOESSER, LEO. J. Bone & Joint Surg., 1934, 16: Jan.
4. JONES, SIR ROBERT. Irish J. Med. Sc., 1932, No. 78, 282.
5. KEY, J. A., and CALDWELL, H. E. The Management of Fractures, Dislocations and Sprains. St. Louis: C. V. Mosby Co., 1934.
6. ROBERTS, SUMNER M. J. Am. M. Ass., 1932, 98: 367–373.
7. ROGERS, HORATIO. Surg. Gynec. & Obst., 1934, 59: 934.

PRIMARY CARCINOMA OF COWPER'S GLAND

ROBERT GUTIERREZ, A.B., M.D., F.A.C.S., New York, New York

SURGICAL diseases of the Cowper glands have received but scant attention in urological practice; in fact, pathological conditions of these two minute organs up to the present time have been regarded as rare. Therefore, it is not surprising to find, upon looking over the literature of the subject, that only 5 cases of primary carcinoma of the Cowper glands are on record.

The frequency of pathological lesions of these bulbo-urethral glands must certainly have been underrated, since their anatomically strategic position in the perineum at the level of the membranous urethra, where their lubricating ducts open, readily invites ascending infection in the most common type of urethritis prevalent in the male.

In gynecological practice infections of the Bartholin glands, the homologues in the female of the Cowper glands in the male, are of quite common occurrence, and many cases of primary cancer of these glands have been reported. Clinical experience reveals, however, that it is rather unusual for pathological conditions to be discovered primarily in the Cowper glands, either because their pre-operative diagnosis is seldom made, or because they are mistaken for some pathological condition of the urethra or prostate, and the true nature of the affection is often not recognized until after the operation when histological sections are made of the specimen removed. In fact there are many cases in which no specimen is obtained and the histological examination is not made.

The purpose of this study is to bring out the clinical importance of these pathological conditions of the lower urinary tract, which may be encountered in routine urological practice and which in many instances produce not only obstructive uropathies but also genital disturbances, demanding early surgical relief—conditions sufficiently common to make it important for the general surgeon and the urologist to bear them in mind when making a diagnosis.

This communication is based on the report of one personal case of primary carcinoma of Cowper glands diagnosed and operated upon by the author, with a review of the literature, and presented in the hope that this work will stimulate further research in this important field.

HISTORY AND LITERATURE

It appears that the two small organs commonly known as Cowper's glands were in reality first briefly described by Méry, a French surgeon, in the *Journal des Savants* of June, 1684. The original description, which amounted to something less than five lines, spoke of "two small glands the size of a pea, which he had seen lying under the male organ, beneath the accelerator muscles, about a thumb's distance from the body of the prostate, and about 2 lines apart from each other." These structures could, of course, be nothing else than the bulbo-urethral glands, to which Cowper independently called attention in 1699, and of which he gave a more detailed description in 1702. Although certain French writers have assiduously tried to maintain the priority of their own countryman's discovery, by calling them "Méry's glands," it seems that Méry himself never pressed the matter and made no protest when Littré (1700), Morgagni, and other contemporaries began to refer to them as Cowper's glands—a name that has now become inseparable from these organs. They have also been called "the glands of Duverney," who mistakenly spoke of them as "inferior prostates"; others of that period termed them "small prostates," "accessory prostates," "adstiti conglomerati" (Terraneus, 1709), antiprostates (Winslow) and "round mucous glands" (Haller).

During the 18th century there was considerable confusion as to their number and their exact location with reference to the prostate and the urethra. Cowper, after describing two glands at the outset, decided later that there were three; and in this conclusion he was upheld by Lieutaud (1742), and Mauget (1716) both of whom thought they found something similar in one or two cases. This led Cruveilhier to make a very detailed search for a third gland, but in the end that author announced that he could find no sign of any such structure. It seems probable, according to Guebler, that what Cowper and the others saw were accessory glandular granules such as sometimes are found accompanying the excretory ducts from the normal Cowper's glands, lying within the corpus spongiosum of the urethra. Cowper, in one of his drawings, it is true, showed an isolated duct coming from the third gland; but as he failed to state in how many subjects he

observed this duct, we must conclude that its existence is exceptional and must be regarded as an anomaly.

Guebler, in 1849, published in a Paris thesis the most extensive study of "Méry's glands" (as he insisted on calling them) that had yet appeared,—a remarkable work embodying an exhaustive search of the literature of the subject as well as his own personal investigations carried out on 20 cadavers. It is to him that we are indebted for what is even today the most complete and authoritative account of the anatomic structure and topographic relations of these glands. With reference to their pathology, he wrote that "while nothing had been written except on inflammations and obliterations, there could be no doubt that with further study it would be found that they are subject to all the changes and diseases that other organs suffer,"—a statement well borne out by modern observations.

Guebler's work formed the basis for a comprehensive thesis from the pen of Lebreton in 1904, which brought the pathology of the glands up to date, and devoted many pages to a clear exposition of acute and chronic cowperitis.

A study of the literature up to the time of Lebreton reveals reports of only 3 cases of primary carcinoma of Cowper's glands. These were recorded by Paquet and Herrmann (1884), Pietrzikowski and Gussenbauer (1885) and Kocher and Kaufmann (1886). In recent years two more proved cases of this rare type of cancer have been reported, namely that of Di Maio in 1928, and that of Uhle and Archer in 1935. In one additional case reported by Blanc, Wies, and Carret (1910), a clinical diagnosis of primary carcinoma of Cowper's gland was made, but as the patient refused operation and was not seen again, the case, although of great interest, can unfortunately not be counted as authentic since it lacked histological confirmation.

Other important contributions in modern times to the study of Cowper's glands have been made by such German writers as Englisch, Elbogen, Hallé and Motz, Hertwig and von Lichtenberg; in Belgium by Hogge; in France by Hartmann and Lécène, by Delbet, Pasteau, Noguès, Reynès, Leszcynski, Papin and Vafiadis, Luys and others; in the United States by Young, Keyes, Hinman, Lowsley and Kirwin, and Walters, and, more recently, by Uhle and Archer, who reported the first case of primary adenocarcinoma of the Cowper glands in America.

To the 5 cases in the literature in which the presence of primary carcinoma of Cowper's glands was proved by examination of the specimen, I am here adding a sixth case of this very rare condition which I have recently had the opportunity of observing.

ANATOMY OF COWPER'S GLANDS

The Cowper glands are two small round or oval glands, frequently flattened, lying in the urogenital floor between the two layers of the median perineal aponeurosis, and between the deep surface of the bulb and the superficial surface of the membranous urethra, at the level of the triangular ligament and the apex of the prostate. In some individuals one or both of these glands may be lacking. Thus, Lebreton reports that, in a total of 15 fresh specimens examined, he saw both glands clearly in 9; in 4 he saw only 1, normally the gland on the left side, and in 2 neither gland at all could be found. Their size varies from that of a hempseed in the newborn to that of a cherry-stone or hazelnut in the adult. When the average glands are developed they are usually separated by a space of 4 to 5 millimeters (Sappey), but if larger than the average they may encroach upon one another and even present the appearance of a single large gland, sitting astride of the membranous urethra (Fig. 1). The two glands may be of the same size, but not infrequently the left is larger, suggesting a possible anatomic reason for the greater frequency of cowperitis on the left side. Deviations from the typical form, size, and position abound.

The glands are mucous, tubo-alveolar structures, racemose in their arrangement; they are of firm consistency, which renders them easy to grasp with the fingers before their complete dissection. Their terminal divisions, after a certain amount of branching, end in irregularly sacculated compartments. After denudation they are reddish in color when first seen through the very close capillary network that surrounds them; when this is removed they are yellowish, and very easy to recognize. They contain a clear and viscous secretion of alkaline reaction.

The excretory ducts that drain the glands are usually about 3 to 4 centimeters in length, and about 1.5 millimeter in diameter. Leaving the glands in a forward and median direction, they plunge into the bulb, through which they pass obliquely on their way to the urethra, which they approach very gradually; they finally become submucous and, after a tract of varying length, obliquely pierce the mucous membrane itself. We can, accordingly, distinguish two portions of the duct: (1) an intraspongious portion and (2) a submucous portion, the second being as a rule two or three times as long as the first. The ducts

tend to become tortuous at the point where they enter the urethra through two small slit-like orifices (Fig. 1), which may be difficult to see, especially in young subjects. Frequently one duct is considerably longer than the other, in which case the orifices are in the same anteroposterior but not in the same transverse line.

Microscopically, the alveoli of the glands are lined with low columnar or pyriform cells, with mucus secreting elements present in great number. The diverticula of the gland are united by intertubular connective tissue and are invested with a fibrous envelope containing both smooth and striped muscle fibers derived from the compressor urethrae muscle. The glands receive their blood supply from branches of the arteries of the bulb, which terminate in capillaries that enclose the alveoli and diverticula.

EMBRYOLOGY

The Cowper glands are formed from the urogenital sinus at an early stage of embryonic life, and are the homologue in the male of the Bartholin glands in the female.

The embryological study of these glands dates from 1840, when Tiedman reported that he saw them in embryos of 5, 6, and 7 months. Since his time numerous authors have engaged in their study, and the date of their appearance has been carried back to as early as the tenth or eleventh week of embryonic life (Hoffmann, 1877). Mueller (1892) concluded that their first appearance is irregular as to time, and that it may take place in embryos from 4 to 8 centimeters in length. He states that the anlagen of both these glands arise first as solid buds from thickening of the epithelium of the urogenital sinus, which later on acquire a lumen. Lichtenberg in 1906 found gland buds unbranched in a 65 millimeter embryo, although both contained lumens; small lateral buds indicated the site of future branching. In an embryo of 70 millimeters an accessory Cowper's gland was present.

Eggerth (1915), who has given us a very detailed account of his observations, states that human embryos, both male and female, of 3 to 6 centimeters crown-breech length, present 3 pairs of lateral folds on the wall of the urogenital sinus, which in the younger stages extend from the ostium urogenitalis to a point about halfway to the place where the mesonephric ducts enter the sinus. They appear first as solid epithelial ridges or folds, arranged symmetrically on the two sides of the urethral plate. In embryos of only 3 centimeters' length he was able to observe the anlagen of Cowper's and Bartholin's glands as solid epithelial buds arising from the median lateral fold near its cephalic end. When the embryo reaches a length of about 4.5 centimeters, the distal portion of the bud develops a knoblike end with a narrower proximal portion in which the beginnings of a lumen can be seen. At 5 to 6 centimeters there is evidence of distal branching of the anlage, cross sections of the gland showing a partial division into 4 or 5 branches, each of these also preluding a lumen. He noted that the development of the glands on the 2 sides is not symmetrical either as to time or extent of growth.

Johnson made wax models of the Cowper glands as he observed them in early embryos (Fig. 2). He traced the developments of the urethra and its various glands from the embryo of 55 millimeters to that of 220 millimeters, and demonstrated that the beginnings of Cowper's glands are already present in a stage at which the bulb itself is not yet apparent.

Anomalies of the Cowper glands are already observed in the fetal stages. Johnson found them in 3 of 15 embryos from 55 millimeters to birth. In 1 case the duct of the right side alone reached the urethra, the left being a branch of it which crossed the midline to reach the gland body. In the 2 other cases, the right and left ducts, respectively, were occluded at their outlets, resulting in a cystic condition from distention. There is no doubt that such anomalies may be responsible for pathological conditions of the Cowper glands appearing in adult life.

TUMORS OF COWPER'S GLANDS

The Cowper glands have until recently been so little known that their diseases, if we except cowperitis, have hardly appeared in the textbooks, but it is now recognized that they are subject to the same general processes of pathology as other organs of the body. The most important of these are (1) acute and chronic cowperitis, (2) cystic formations, (3) tuberculosis, (4) calculosis and (5) tumors. Our concern here is with the last named group alone. Lebreton in 1903 found records of only 3 cases of primary malignant tumor of Cowper's glands in the literature. These, as we have seen, were the cases of Paquet and Herrmann (1884), of Pietrzikowski (1885), and Kocher (in Kaufmann) (1886). In all these cases the existence of epithelial malignant tumors that had developed from the substance of Cowper's gland was established beyond question (Fig. 3). In every one the histological examination proved that the tumors were carcinomas, that is, atypical epitheliomas developed from the epithelium of the acini of the gland, their structure recalling

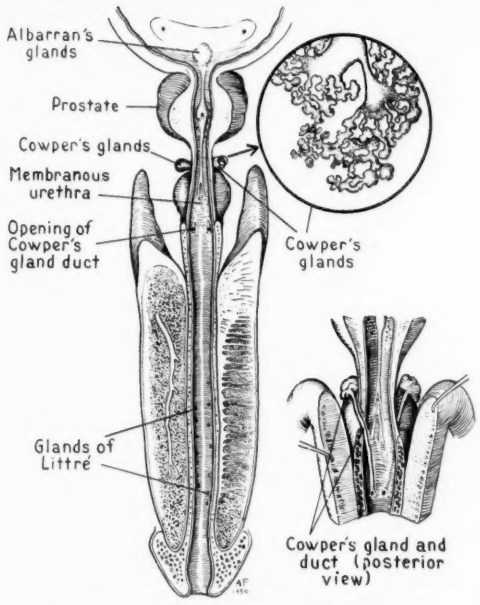


Fig. 1. Frontal section in diagrammatic form showing the topographic relationship of the Cowper glands and their ducts to the membranous portion of the urethra; also the interrelationships of the different urethral glands at various levels of the urethra. The circle on the right is a graphic representation of the racemose internal structure of the glands of Cowper. The drawing in the lower right corner is a schematic view of the posterior portion of the bulbomembranous urethra, indicating the anatomic position of the Cowper glands and their corresponding ducts as they empty into the membranous urethra. (Modified drawing from Testut, Sappey, Toldt, and others.)

absolutely that of a cylindroma. The histories of the second and third cases would seem to indicate that such tumors are of very great malignancy. In the second case, the subject was a youth only 19 years of age. In none of these cases was the exact diagnosis made previous to surgical intervention.

In 1910 Blanc, Wies, and Carret reported a case on which they were not permitted to operate, but which was clinically diagnosed by them as carcinoma of Cowper's gland, on the basis of a hard, painless, infiltrated mass lying in the median perineal region, unaccompanied by any urinary disturbances, but associated with a few hard, painless nodules in both groins. However, as the patient refused operation and left the hospital after 6 days' observation, this case can, unfortunately, not be counted among verified instances of carcinoma of the Cowper glands.

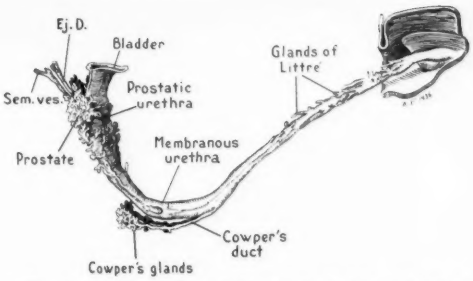


Fig. 2. Reconstruction of the glands of the urethra in a wax model from an embryo, after Johnson, showing the anatomical position of the Cowper glands and the Cowper ducts at the level of the membranous urethra, in an early stage of embryonic life.

In 1928 Di Maio reported a fourth case, confirmed by biopsy, in which a malignant growth of the Cowper gland was present. Here there were no symptoms within the urinary tract and the endoscopic findings were negative. There was no external tumefaction, but, upon rectal examination, a large mass could be felt. The patient was a cavalryman who was used to sitting in his saddle all day, and as the growth went on the discomfort of this amounted to torture. This pain and the appearance of urethral hemorrhages brought him for examination earlier than he might otherwise have come, and thus made possible the diagnosis, at a comparatively early stage, of a malignant growth associated with hemorrhagic cysts of Cowper's gland.

Quite recently (1935) Uhle and Archer have reported a fifth proved case of carcinoma of Cowper's gland which they observed in Randall's service in Philadelphia. Here the patient was only 32 years of age, and the case was marked by the finding of a normal prostate, a complete absence of urinary symptoms, and the presence of knife-like pain in the rectum, leading to the discovery of a firm, tender nodule just inside the internal sphincter. Histological examination of the excised tumor mass revealed an adenocarcinoma of the Cowper glands.

To these 5 cases I am now adding a sixth case that has recently come under my notice, and upon which I have had the opportunity to operate.

REPORT OF AUTHOR'S CASE

A case of primary carcinoma of the Cowper glands in a man 70 years of age, who had been suffering for over 40 years with a genito-urinary condition which had been erroneously diagnosed on several occasions and for which he had undergone extensive treatment, including several operations, without relief. He was born with a right undescended testis and a very small meatus, for which a meatot-

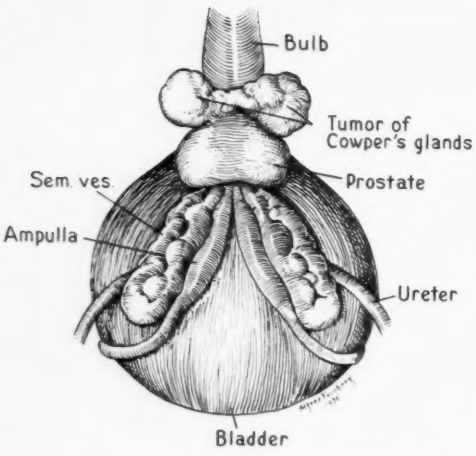


Fig. 3. Diagrammatic representation of tumors of the Cowper glands anatomically situated at the level of the bulbomembranous portion of the urethra and at the apex of the prostate, from which, however, they are clearly separated by Denonvillier's fascia, as in the author's case here reported.

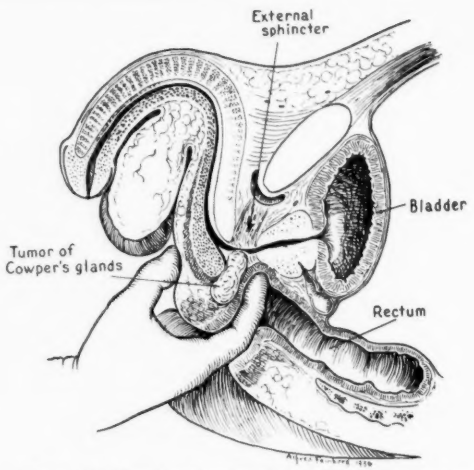


Fig. 4. Sagittal view showing the method of examination of Cowper's glands. This drawing illustrates the growth of the tumor of Cowper's glands, in the perineum, between the urethra and the rectum, at the apex of the prostate and involving the external sphincter, which caused the attack of complete retention in the author's case here reported.

omy had been performed. He had a history of gonococcus infection in early youth and had allegedly been suffering for many years with chronic orthostatic albuminuria; he had also received treatments in many localities here and abroad for stricture of the urethra, on account of persistent pain in the perineum, together with frequency and dribbling; in addition on account of rectal pain, he had had 3 operations for supposed internal hemorrhoids, and on 2 other occasions dilatation of the rectum for stricture, but still without relief. He had a very sensitive urethra, marked dysuria and frequency of urination, day and night, for which he was finally referred to me on December 28, 1935. Upon urologic examination I found that the underlying cause of his symptoms was a hypertrophy of both Cowper glands, with marked cowperitis, induration and calcification, which, clinically, pointed to a malignant growth of the Cowper glands. The histological examination of the specimen removed at operation by perineal cowperectomy revealed the presence of a primary adenocarcinoma of Cowper's gland.

M. H., a retired banker, 70 years of age, was referred to me for examination on December 28, 1935. His chief complaints were marked frequency of urination, day and night, with dysuria, urgency and perineal pain, from which symptoms he had been suffering for several years. Patient had had the usual childhood diseases, without incident. He denied luetic infection by name and symptoms. At the age of 20 he had contracted a gonococcus infection, and has been complaining of stricture of the urethra almost ever since this urethral infection; also of complications of cystitis and prostatitis, for which he had received treatments here and abroad for many years. He had also suffered from rectal pain and alleged hemorrhoids, for which he had been operated on several times, apparently without relief. During his early thirties, he underwent several physical examinations with a view to taking out life insurance, but was refused on the ground that he had marked albuminuria, pointing to Bright's disease, which made him a poor risk, and that his life expectation was not more than 18 years at most.

Patient complains of difficult urination and marked urgency both day and night. He states that on the preceding night he had an attack of partial retention of urine, but had obtained some relief with a hot sitz bath and a rectal douche. He complains of persistent itching in the urethra, slight pain in the perineum, the bulbar portion of the urethra and the rectum. He has been given diathermy treatment for his prostatic conditions, without relief; he suffers with dribbling, change in the urinary stream, marked dysuria, frequency, and burning urination; if he takes a long drive he has persistent dull pain in the perineal region, extending to the rectum and urethra.

Physical examination revealed the following: The patient is a stout, well developed and well nourished individual; blood pressure normal, and chest examination negative. Neither kidney is palpable, no masses nor abdominal distention can be made out; the external and internal inguinal ring is negative for hernia. The glans penis is normal, there is no discharge present at meatus, and the scrotum on the right side is slightly shorter; on palpation the right side was found to be empty, and the right testis and epididymis were located above the external inguinal ring—this revealing the fact of a right undescended testis.

Rectal examination shows what may have been explained to the patient as "external hemorrhoids," but was in reality nothing but redundant tissue from previous rectal operations. The sphincter appeared to be of good tone. With the index finger in the margin of the rectum and the thumb making slight pressure on the perineum, two irregular hypertrophic nodular masses could be felt, giving the impression that they were attached to the rectal wall and were independent of the prostate gland (Fig. 4). These two masses, which were tender on palpation, and rather hard and indurated here and there, gave the impression of calcification or of stones disseminated in the Cowper glands, with marked cowperitis, cyst or abscess formation, and

possible malignant growth of the Cowper glands. The prostate, which was enlarged to about three times its usual size, was situated far behind these hypertrophic masses of the Cowper glands, and was of leathery consistency and adenomatous in type. The right and left seminal vesicles were slightly palpable, but apparently normal. No prostatic fluid was obtained for microscopic examination. The urine test showed the first glass clear, with shreds; second glass clear, third glass hazy. The urethra was permeable to a No. 14 silk catheter, and a No. 20 French sound, which was passed with slight difficulty. The patient had 1 ounce of residual urine. In view of the marked sensitivity of the urethra, further instrumentation was postponed in order to relieve the acute symptoms from which he was suffering.

Impression. (1) Right undescended testis. (2) Chronic cowperitis with marked hypertrophy and induration of these glands, accompanied by cysts and stone formation, with possibility of a malignant growth. (3) Adenomatous hypertrophy of the prostate. (4) Stricture of the urethra.

At this time the patient refused operation, and was satisfied to receive palliative office treatment of his urologic conditions, although he was informed that the Cowper glands, which were responsible for all the urinary and rectal symptoms with which he had been suffering for so many years, would sooner or later involve the external sphincter of the urethra and induce an attack of complete retention of urine (Fig. 3).

On Sunday, March 29, 1936, the expected attack of retention came. I was called early in the morning by the patient's wife, who stated that her husband was unable to urinate and had been suffering intensely all night with pain in the suprapubic region and marked bladder and rectal tenesmus. After I had relieved the acute retention of urine, I proposed a consultation with his family physician and also with another urologist, to substantiate my findings, which was agreed to.

Roentgenographic and urographic examinations were carried out. The plain film was entirely negative with reference not only to Cowper's gland pathology but to shadow indicative of stone anywhere in the urinary tract. After the intravenous administration of 20 cubic centimeters of iopax, x-ray pictures were taken, revealing that both kidneys had good eliminatory function and that they were normal in size, shape, and position. The pelves, ureters, and bladder were also well outlined, and normal. Urethrocystograms in both anteroposterior and lateral views disclosed that the entire lumen of the urethra and the bladder were distended with the opaque substance but were negative to the presence of pathology in the Cowper glands.

April 1, 1936. After making a rectal examination, Dr. Alfred T. Osgood, called in consultation, agreed with my findings that the attack of acute retention of urine might have been due to this hypertrophy and induration in the Cowper glands, and wholly independent of the prostate. He also recommended that the patient be hospitalized with a retention catheter and that these hypertrophied, indurated Cowper's glands be removed by way of the perineum. The family physician, Dr. Laurence W. Whittemore, also agreed with this recommendation, and the patient was finally admitted to the hospital for operation.

The interior of the bladder was found negative on cystoscopic examination except that there was a small amount of bulbous edema at the floor of the bladder neck, probably caused by the retention catheter. Upon withdrawing the instrument, a slight lateral prostatic intrusion was seen, indicating a moderate degree of prostatic hypertrophy, but not sufficient to account for the obstruction. The rest of the urethra was carefully examined and was apparently negative. The two orifices of the Cowper glands ducts were not seen. With these negative cystoscopic findings the patient was prepared for the operation of perineal cowperectomy.

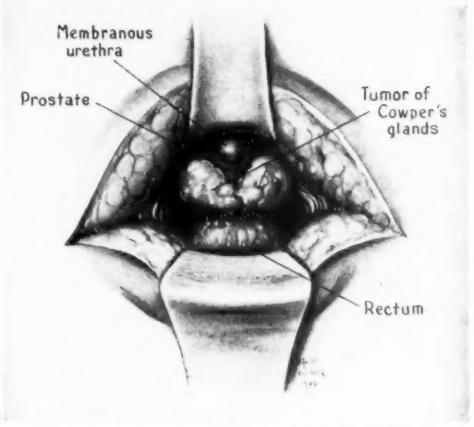


Fig. 5. Operative technique of perineal cowperectomy, showing the intimate relationship of the infiltrating tumor mass of Cowper's glands, strongly adherent to the rectal wall and to the membranous portion of the urethra. After total removal of this indurated mass by the perineal route the prostate lay directly behind, separated by Denonvillier's fascia, which served as a plane of cleavage to prevent invasion of the prostate by the malignant growth, thus indicating the value of early perineal total cowperectomy.

TECHNIQUE OF PERINEAL COWPERECTOMY

After administration of spinal anesthesia the patient was placed in the exaggerated lithotomy position as in perineal prostatectomy. With the usual preparation the long seminal vesicle urethral tractor was passed into the bladder without difficulty; a curved incision was made in the perineum, from one ischial tuberosity to the other between the scrotum and the rectum. The incision was carried deeper on each side of the midline into the ischiorectal fossa, by blunt dissection; the central tendon was then divided, allowing the bulbar portion of the urethra to be retracted, and some remaining fibers of the rectourethralis muscle were dissected and cut with scissors. At this time it was recognized that there was a considerably indurated and hypertrophic mass of tissue which occupied the entire floor of the perineum, and which because of its close attachment to the membranous bulbar portion of the urethra and to the rectal wall was quite difficult to isolate. A finger was then inserted into the rectum to serve as a guide during the further dissection of this hardened and almost calcified tissue and also to protect that viscus

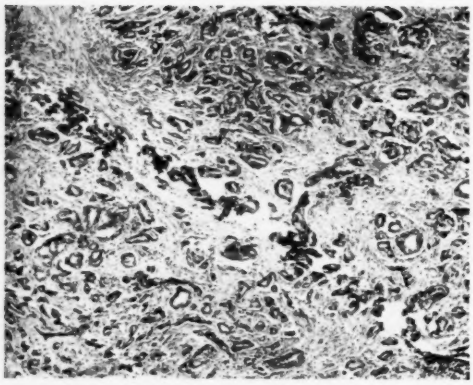


Fig. 6. Photomicrograph of an area of the specimen removed at operation, revealing an atypical neoplastic proliferation of the acinous portion of the Cowper glands. ×70.

from injury. After slight difficulty in advancing the dissection, a perineal retractor was placed in the perineum to give proper protection to the rectal wall; the index finger was withdrawn from the rectum and the gloves were changed. At this time clamps were placed here and there to stop bleeding and ligatures were made.

With further dissection of the perineum, the tumor masses that were attached on each side of the rectum were separated and entirely freed from their attachment to the wall of the rectum (Fig. 5). These two masses were about the size of two large olives, of irregular shape, and hard as a rock; they appeared to be surrounded by cyst formation and some calcifications. While an Allis clamp was being placed in the growth, a few drops of green pus were seen, of which cultures were made. These hard masses were clearly separated from the prostate gland, and although close to it, were not in the least attached to it. It was evident that there was a perfect line of cleavage between this growth of the Cowper glands and the prostate itself. Apparently the prostatoperitoneal aponeurosis, or Denonvillier's fascia, was acting as a diaphragm or protecting membrane to prevent the invasion of the prostate gland. Although this growth was firmly attached to the membranous urethra where the Cowper gland ducts were anatomically situated, the urethra itself had not been invaded. After the hard tumor masses of the Cowper glands were entirely removed and a total cowperectomy accomplished, the prostate could be felt all the way around, showing that there were no adhesions to the rectal wall. However, as there was some induration on the posterior and right lateral lobe, it was decided to remove a piece for histological examination; otherwise the prostate gland was not disturbed. At no time during the procedure was the membranous urethra opened or injured.

After proper cleansing and insertion of a few hot compresses to stop oozing, the wound was re-examined to assure that no pieces of the growth of the Cowper gland had been left behind; after which, with the clinical impression of definite carcinoma of Cowper's glands it was closed in the usual manner. The floor of the perineum was closed, bringing the two levator ani muscles together with chromic catgut sutures, and the skin was closed with interrupted silkworm gut sutures, a cigarette drain being placed on the right side. A retention catheter No. 22 was then passed into the urethra without difficulty; the bladder was irrigated and the return fluid was pinkish but rather clear. The catheter was fixed in position and the patient returned to his room in good condition.

The patient's convalescence was uneventful up to the sixth day; the perineal wound was dressed daily; the packing was removed at the end of 48 hours, the catheter irrigated daily with silver nitrate 1:10,000 and on the sixth day removed, since the patient was complaining of pain in the urethra. The stitches were removed on the sixth postoperative day, and the perineal wound, which was healthy and clean was packed lightly with balsam of Peru to stimulate granulation and prompt healing of the entire wound.

April 16, 1936. Twelve days after operation, while the patient was recuperating from his perineal cowperectomy, he suddenly developed a chest complication in his left lung, for which Dr. Whittemore, Dr. William R. Williams, and Dr. James Morley Hitzrot were called in consultation. The first x-ray films were negative; 2 days later x-ray films were repeated and showed the presence of fluid in the left pleural cavity, which went on to the formation of an empyema. After 3 different tappings, each of which elicited some 400 cubic centimeters of pus, a thoracostomy was done by Dr. Hitzrot, under local anesthesia on April 18th, and a large rubber tube was introduced into the lung for drainage. The patient bore the operation well, but on the following day his condition became worse. Innumerable attempts were made to save his life, but all proved vain, and on April 26 death supervened as the result of general sepsis arising from the empyema. The specimen removed at operation consisted of several pieces of hard indurated glandular tissue which corresponded to the firmly adherent and infiltrated growth removed from the perineum and submitted to the pathologist for histological examination. The report of the pathologist, Dr. James Ewing, submitted on April 14, 1936, was of great interest, in that the microscopic study showed an infiltrated, malignant grade 2 plus adenocarcinoma, involving all parts of the Cowper gland material submitted, with a slight tendency to the development of cysts within the growth of papillary adenocarcinoma (Figs. 6 and 7). Many of the areas of the neoplastic mass showed very wide adenocarcinomatous acini distended by a network of epithelial strands. In some areas there were elongated papillary structures with thin strands of stroma lined by opaque cubical epithelium, with atypical features not met with in prostatic cancer. In another area the tumor took the form of very numerous small regular acini

lined by opaque cells. In other portions there were peculiar compact medium sized acini, lined by rather large granular cells. On the whole, Dr. Ewing said, the structure of the adenocarcinoma was quite consistent with an origin from the Cowper glands.

Pathological diagnosis: adenocarcinoma of Cowper's glands.

The study of this case report suggests several possible hypotheses with reference to the underlying etiology responsible for the formation of primary adenocarcinoma of the Cowper glands. It serves also to bring out the difficulties in diagnosis and to point out the many years of suffering and unnecessary surgical treatment which this patient had undergone because of erroneous diagnosis.

First of all, it appears that the "orthostatic albuminuria" from which he was suffering in his early youth and on account of which he was rejected in a life insurance examination for Bright's disease, was nothing but the presence of mucin coming from an undiagnosed cowperitis. It is logical to assume that in cases of cowperitis following urethritis the Cowper glands will excrete an excess of glandular fluid, and, as Henle and other early investigators have demonstrated, the fluid from the Cowper glands contains an excessive amount of albuminoid substance, which can be readily detected in a routine urinalysis. In this instance this was clearly the case, for the patient lived to be 70 years of age and the intravenous urograms that I took revealed that both kidneys were entirely normal. It is obvious that the symptomatology in these cases is often misleading, particularly when these patients most commonly complain of rectal symptoms and go first to the family physician and the proctologist for relief. This case history reveals that the patient had had 3 operations for hemorrhoids and 2 dilatations of the rectum made under general anesthesia in the last 10 years, when in reality the underlying cause of his trouble was the presence of an undiagnosed pathological condition of the Cowper glands.

An analysis of the 5 cases collected from the literature and reported in résumé in the attached table (Table I) reveals that all of these patients with primary carcinoma of Cowper's glands are complaining of a syndrome characterized mainly by pain in the rectum, a tumor mass in the perineum and presence of urinary disturbances, for which they finally come to the urologist for examination.

Although the etiological factors in the new-growth formation are at present not definitely known, it can be assumed in this case that, as a result of the pathological changes produced by

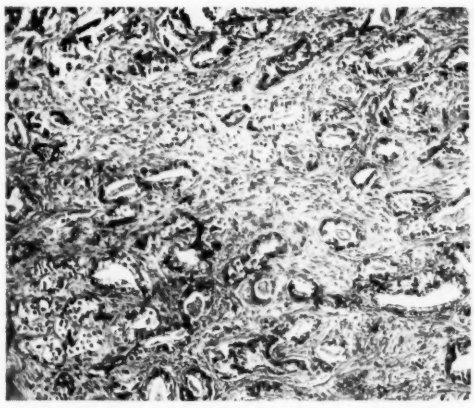


Fig. 7. Photomicrograph of another section of the specimen removed at operation, showing the characteristic features of adenocarcinoma of Cowper's glands. × 125.

infection of the Cowper glands in early life, there had been an obliteration of the Cowper duct with ectasia and cyst formation, as well as calcification or possible stone formation of the glands and their ducts. The lack of drainage and the persistent interstitial inflammation, together with the absence of any proper capsule of the organs, and the fact of the constant trauma to which these glands are subjected in the perineum, may lead to the formation of a new-growth of infiltrating character, spreading into the tissues of the perineum and the entire periglandular region. In 2 of the cases, namely the one reported by Pietrzikowski and my own case, the tumor mass had extended upward and involved the external sphincter, finally resulting in complete retention of urine.

The age incidence of these 6 authentic cases was 65, 19, 57, 65, 32, and 70 years, showing that this malignant growth may develop in Cowper's glands at any age.

The trauma incident as the primary cause in the etiology of the formation of cancer was evident in Kocher's case, since the patient had had a straddling injury of the perineum 12 years previous to the appearance of the tumor. In most of the cases reported the growth was of infiltrating character and was firmly adherent to the bulbomembranous portion of the urethra, as well as plastered to the lower portion of the rectal wall, so that in the surgical treatment, as in the cases of Paquet, Kocher, Di Maio, and Uhle and Archer, dissection of the perineum was very laborious and a partial section of the adherent portion of the bulb to which the tumor was

TABLE I.—SUMMARY OF CASES OF PRIMARY ADENOCARCINOMA OF COWPER'S GLANDS COLLECTED FROM THE LITERATURE

No. Age	Author	Symptoms	Clinical diagnosis	Pathologic findings	Operation	Result	Remarks
1 65	Paquet and Herrmann 1884	Small perineal tumor on palpation. Slight urinary disturbances, early. Intense pain on defecation	Hypertrophy of Cowper's glands	Epithelioma of Cowper's gland	Removal of Cowper's glands	Cured (2 yrs. later)	Tumor adherent to bulb which was partially resected leaving urinary fistula
2 19	Pietrzikowski and Gussenbauer 1885	Hard tumor about size of egg on palpation of perineum. Late urinary symptoms. Retention. Pain on defecation	Hard tumor of perineum	Carcinoma of Cowper's glands; metastasis to inguinal region	Excision of tumor of Cowper's gland and of inguinal glands	Recurrence within a few months. Death	
3 57	Kocher 1886	Perineal pain, worse on sitting or walking. Slight dysuria, frequency and burning	Hard tumor surrounding the membranous urethra and unrelated to prostate	Carcinoma containing débris of Cowper's glands	Median incision along raphe. Cowperectomy with excision of part of membranous urethra	Recurrence 17 months later. Small perineal tumor size of pea removed. Cured for 1 year	Injury in perineum 12 years previous to appearance of tumor
4 65	Di Maio 1928	Severe pain in perineum. Hemorrhages from urethra. Tumor of insidious beginning, about size of hen's egg, discovered on rectal examination	Probable cyst of prostate	Adenocarcinoma of Cowper's gland	Wide perineal incision with removal of tumor of Cowper's gland	All symptoms relieved, wound closed in 3 wks. No further report	Tumor was hard, surrounded by cysts infiltrating the bulb and floor of perineum
5 32	Uhle and Archer 1935	Sharp knife-like pain in rectum, 6 months' duration: marked constipation. Fistula *in ano*, mass in perineum	Tumor mass in perineal region	Adenocarcinoma of Cowper's gland	Excision of perineal tumor mass followed by radium seeds and deep x-ray treatments	Good condition 1 year later	Treated for fistula *in ano*
6 70	Gutierrez 1936	Dysuria, albuminuria, frequency, retention. Pain in perineum and rectum, tumor mass in perineum on rectal palpation	Tumor of Cowper's glands	Adenocarcinoma of Cowper's glands	Total perineal Cowperectomy	22 days after operation death from general sepsis following an empyema of pleural cavity	Treated for hemorrhoids, stricture of urethra, prostatic trouble, operated upon 3 times for internal hemorrhoids, twice for dilatation of rectum

attached was also removed. It is to be noted that in instances in which the urethra has been opened, as in Cases 1 and 5 of the accompanying table, a urinary fistula had persisted for some time, which is rather a characteristic feature of all malignant tumors of the perineum and lower urinary tract.

The clinical diagnosis of any pathological condition of the Cowper glands is very seldom made unless one thinks of the possibility of its existence. A tumor of these glands may readily be mistaken for stricture of the urethra, peri-urethral or perineal abscess, diverticulum of the urethra, calcified cyst or stone or tuberculosis not only of the urethra but also of the prostate. The final diagnosis must be made on the histological section of the specimen removed at operation, as the only way to establish its authenticity.

Routine roentgenographic examination as well as urethrocystography may be of value in diagnosis of pathological conditions of the Cowper glands, particularly when the Cowper ducts are patent and the condition can be outlined by the injection of a contrast medium. The author recently had an opportunity to see in the Urological Service of the Hôpital Cochin of Prof. Chevassu in Paris a beautiful case of tuberculosis of the Cowper glands urethrographically diagnosed. Of course, in all these cases the routine urethrocystoscopic examination should always be made so that even if a diagnosis of Cowper gland pathology cannot be reached, it may at least be possible to rule out other pathology of the prostatic urethra or at the bladder neck.

The classic routine rectal examination is the most important way of establishing the clinical diagnosis (Fig. 4). It may be helpful to repeat this examination after placing a sound in the urethra, so that the entire urethral canal can be palpated and a Cowper gland condition readily differentiated from any other lesion of the lower urinary tract.

The prognosis of primary cancer of the Cowper glands is very grave. An analysis of the cases reported up to the present time shows that none of them has met the test of a 5 year cure.

As regards treatment, a study of the 6 cases reported in the literature indicates that as soon as the diagnosis is made there should be a total perineal cowperectomy without opening the membranous urethra or injuring the rectum. The steps in the technique of this operation, which has been discussed here in detail, are the same as those that the author has used in more than 200 consecutive cases of perineal prostatectomy and seminal vesiculectomy.[1,2] As soon as histological examination of the specimen removed has proved the presence of a malignant growth, the operation should be followed by implantation of radium seeds in the perineum and by deep x-ray treatments, as was done in the recent case of Uhle and Archer, in which the patient appears to be in good condition 1 year after operation. In my own case here reported the radiation treatment was not used on account of the fatal complications that developed 12 days after operation.

SUMMARY AND CONCLUSIONS

The purpose of this presentation is to place on record a new case of primary adenocarcinoma of Cowper's glands, clinically diagnosed and operated on by the author and confirmed by histological examination.

The literature has been reviewed. Only 5 previous cases of this kind have been reported, all of which are here tabulated and summarized, together with the author's case, in Table I.

The study has revealed that while pathological conditions of the Cowper glands are rarely diagnosed clinically, their incidence must have been greatly underestimated since the strategic anatomical position of these glands in the perineum at the level of the membranous urethra invites ascending infection with potential sequels of surgical pathology.

The symptomatology in carcinoma of the Cowper glands is readily confused with conditions of the rectum and lower urinary tract. The cardinal symptoms are pain in the rectum and perineum, tumor mass in the perineum, and urinary disturbances which may go so far as to produce complete retention.

The treatment when the clinical diagnosis is established is the complete removal of the growth by a total perineal cowperectomy followed by implantation of radium seeds and deep x-ray treatment.

The prognosis is very grave, no case having yet met the test of a 5 year cure. It may be assumed, however, that with early diagnosis and the institution of proper surgical treatment better results will be obtained.

[1]Gutierrez, R. Later results of surgery of the seminal vesicles. Report of one hundred consecutive seminal vesiculectomies. J. Am. M. Ass., 1929, 93: 1944–1951.

[2]Idem. Surgery of the seminal vesicles, ampullæ and vasa deferentia. Oxford Loose-Leaf Surgery, Vol. 3, pt. 2, pp. 301–509. New York: Oxford University Press, 1935.

REFERENCES

1. ALBARRAN, J., and LEGUEU, F. Maladies de l'urètre. In: Traité de Chirurgie. By Le Dentu and Delbet. pp. 273–518. Paris: J. B. Baillière et fils, 1900.
2. BLANC, WIES, and CARRET. Cancer des glandes de Cowper. Loire méd., St. Étienne, 1910, 29: 375–379.
3. COHEN, H., and DOURMASHKIN, R. L. Chronic cowperitis. Urol. & Cutan. Rev., 1923, 27: 151.
4. COULLIARD, J. Contribution à l'étude des affections des glandes bulbo-urétrales. Thèse de Paris, 1876.
5. COWPER, W. Two new glands near the prostate gland, with their excretory ducts, lately discovered. Philos. Tr., Lond., 1699, p. 258; 1700, pp. 194–197.
6. Idem. Glandularum quarundam nuper detectarum descriptio. London, 1702.
7. CROUSE, HUGH W. Retention cysts of Cowper's ducts. Bull. El Paso Co. Med. Ass., 1911, September 18.
8. CRUVEILHIER, J. Anatomie pathologique du corps humain. Paris: J. B. Baillère, 1829.
9. DEBIERRE, C. Développement de la vessie, de la prostate, et du canal de l'urètre. Thèse de Paris, Doin, 1883.
10. DELBET, P. Urètre. In: Anatomie humaine. By Poirier-Charpy. Paris, 1901.
11. DI MAIO, G. Cancro primitivo della glandola di Cowper. Gazz. d. osp., 1928, 49: 1012–1017.
12. DOBLE, F. C. The Urethra and the Urethroscope. Oxford Med. Pub., London, 1923.
13. EGGERTH, A. H. On the anlage of the bulbo-urethral and major vestibular glands in the human embryo. Anat. Rec., 1915, 9: 191–206.
14. ELBOGEN, A. Zur Kenntniss der Cystenbildung aus den Ausfuehrungsgaengen der Cowper'schen Druesen. Ztschr. f. Heilk., 1886, 7: 221.
15. ENGLISCH, J. Ueber Retentioncysten der Zufuehrungsgaenge beider Cowpers'chen Druesen. Tagebl. d. deutsch. Naturforsch. u. Aerzte, 1881, 54: 148.
16. Idem. Ueber Obliteration und Erweiterung der Ausfuehrungsgaenge der Cowper'schen Druesen. Med. Jahrb., 1883, pp. 289–308.
17. Idem. Ueber chronische Geschwuelste und Fisteln der Cowperschen Druesen. Wien. Klin. Rundschau, 1895, 60: 694–696.
18. ESCAT. Rôle des glandes de l'urètre dans les suppurations périurétrales. Ann. d. mal. d. org. génito-urin., 1904, p. 1761.
19. FELIX, W. Development of the urogenital organs. In: Human Embryology. By Keibel and Mall. 1910, vol. 2.
20. GRASSIN. Contribution à l'étude de la cowpérite et de la péri-cowpérite aiguës. Thèse de Paris, 1886.
21. GRUGET, A. De la fistule de la glande de Cowper. Thèse de Paris, 1876.
22. GUEBLER, A. Des glandes de Méry et de leurs maladies chez l'homme. Paris, 1849.
23. GUÉPIN. Exploration de la glande de Méry. Tribune méd., Par., 1896, 28: 489.
24. GUITERAS, R. Textbook of Urology. Vol. 2, p. 497. New York: D. Appleton & Co., 1918.
25. GUTIERREZ, R. Later results of surgery of the seminal vesicles. Report of one hundred consecutive seminal vesiculectomies. J. Am. M. Ass., 1929, 93: 1944–1951.

26. Idem. Transurethral treatment of bladder neck obstructions. Endoscopic prostatic resection. In: History of Urology. Chap. 5, vol. 2, pp. 137–186. Baltimore: Williams & Wilkins Company, 1933.
27. Idem. Surgery of the seminal vesicles, ampullæ and vasa deferentia. In: Oxford Loose-Leaf Living Surgery. Chap. 9, vol. 3, pp. 300–509. New York: Oxford University Press, 1935.
28. Idem. Surgery of the Seminal Vesicles. In: Cabot's Modern Urology. 3d ed., chap. 17, vol. 1, pp. 613–647. Philadelphia: Lea & Febiger, 1936.
29. Haas, J. Contribution à l'étude des cowpérites dans l'urétrite chronique. Thèse de Paris, 1906–1907, No. 276.
30. Hallé, N., and Motz, B. Tuberculose de l'urètre postérieure. Ann. d. mal. d. org. génito-urin., 1903, 21: 481.
31. Haller. Cited by Lebreton.
32. Hartmann, H., and Lécène, P. La tuberculose de la glande de Cowper. Compt. rend. de l'Ass. franç. d'urol., 1902, 6 ses., p. 237.
33. Hertwig, O. Die Elemente der Entwicklungslehre des Menschen und der Wirbeltiere. 6th ed. Jena: G. Fischer, 1920.
34. Hinman, F. The Principles and Practice of Urology. Philadelphia: W. B. Saunders Co., 1935.
35. Hoffmann, G. Lehrbuch der Anatomie des Menschen. Erlangen, Bd. 1, part 2, p. 695, 1877.
36. Hogge, A. Réchèrches sur les muscles du périnée et du diaphragme pelvien, sur les glandes dites de Cowper et sur la développement de ces organes. Ann. d. mal. d. org. génito-urin., 1904, 22: 1041, 1121, and 1201.
37. Horovitz, M. Die Krankheiten der Cowper'schen Druesen. In: Klin. Handbuch der Harn. u. Sexuelorgane. By Suelzer. Vol. 3, pp. 298–300. Leipzig, 1894.
38. Johnson, F. Later development of the urethra in the male. J. Urol., 1920, 4: 447–501.
39. Idem. The homologue of the prostate in the female. J. Urol., 1922, 8: 13–33.
40. Idem. Diverticula and cysts of the urethra. J. Urol., 1923, 10: 295–310.
41. Kaufmann. Verletzungen und Krankheiten der maennlichen Harnrohre. Deutsche Chirurgie, Lief. 40. Stuttgart, 1886.
42. Keyes, E. L. Urology. New York: D. Appleton & Co., 1928.
43. Kocher. Cited by Kaufmann. In: Deutsch. Chir., 1886, 50: 164.
44. Lacquière and Bouchard. Cowpérite calculeuse. J. d'urol., 1926, 22: 47–48.
45. Lebreton, P. Contribution à l'étude des glandes bulbo-urétrales et leur maladies. Thèse de Paris, 1903–1904, p. 239.
46. Leszcynski, R. Sur la cowpérite chronique latente. Ann. d. mal. vén., 1922, 17: 416.
47. Lichtenberg, A. von. Beitraege zur Histologie, mikroskopische Anatomie, und Entwickelungsgeschichte des Urogenitalkanals des Mannes und seiner Druesen. Anat. Hefte, Bd. 31, 1906.
48. Lieutaud, J. Essais anatomiques. Paris, 1742.
49. Littré. Sur la description de l'urètre de l'homme. Mém. Acad. roy. d. sc., 1702.
50. Lowsley, O. S., and Kirwin, T. J. Textbook of Urology. pp. 358–375. Philadelphia: Lea & Febiger, 1926.
51. Luys, G. Traité de la blennorrhagie et de ses complications. 3d ed. Paris: Doin, 1921.
52. Lyle, H. H. Primary carcinoma of the Bartholin gland. Ann. Surg., 1934, 100: 993–995.
53. Mauget, J. J. Theatrum anatomicum. Geneva, 1716.
54. Méry, J. Cited by Lebreton. J. d. savants, 1684, No. 17, p. 304.
55. Morgagni. Adv. anat., 4 an. 15. Leyden, 1741.
56. Morris. Human Anatomy. Chapter by Jackson, C. M. 8th ed. Philadelphia: P. Blakiston's Sons, 1929.
57. Motz, B., and Bartrina, J. M. Contribution à l'étude des abscès périnéaux et des phlegmons diffus d'origine urétrale. Ann. d. mal. d. org. génito-urin., 1903, 21: 1601.
58. Mueller, V. Ueber die Entwickelungsgeschichte und feinere Anatomie der Bartholini'schen und Cowper'schen Druesen des Menschen. Arch. f. mikr. Anat., 1892, vol. 39.
59. Nicolle. De la cowpérite. Thèse de Paris, 1873.
60. Noguès, P. Inflammations des glandes de l'urètre: cowpérites. In: Encycl. franç. d'urol., 1922, 5: 351–367.
61. Ozenne. Cowpérite bilatérale grave chez un bicycliste. Ann. d. mal. d. org. génito-urin, 1901, p. 1233.
62. Papin and Vafiadis. Tuberculose primitive de la glande de Cowper. Bull. Soc. franç. d'urol., 1922, 1: 84; J. d'urol., 1922, 13: 280–282.
63. Paquet and Hermann, G. Sur un cas d'épithélioma de la glande de Cowper. J. de l'anat. et physiol., 1884, 20: 615.
64. Pasteau, O. Les cowpérites dans l'urétrite chronique. Compt. rend. de l'Ass. franç. d'urol., 1906, 10: 267.
65. Petit, L. H. Sur la découverte des glandes bulbo-urétrales par Jean Méry. Union méd., Par., 1887, 34: 803.
66. Piersol. Normal Histology. Chapter by Addison, W. H. F. P. 283, 14th ed. Philadelphia: J. P. Lippincott Co., 1927.
67. Pietrzikowski, E., and Gussenbauer. Ein Fall von primaerem Carcinom der Cowper'schen Druesen. Ztschr. f. Heilk., 1885, 6: 521.
68. Reliquet and Guépin. Symptomes de la cowpérite, traitement. Ann. de méd. scient. et prat., 1895, 5: 273.
69. Reynès, H. Cowpérite chronique fistulo-périnéale; etc. Ass. franç. d'urol., 1908, 12: 256.
70. Sappey, M. P. C. Traité d'anatomie déscriptive. 2d ed. 1873, vol. 4, p. 622.
71. Terraneus. De glandul. ad urethr. Turin, 1709.
72. Testut, L. Anatomia Humana. Vol. 4, pp. 793–797.
73. Thomson, D. Gonorrhea. London: Oxford University Press, 1923.
74. Tiedemann, F. Von den Duverney'schen Bartholini'schen, oder Cowper'schen Druesen des Weibes. Heidelberg and Leipzig. Quoted from v. Mueller, 1840.
75. Tuffier. Abscès des glandes de Cowper, simulant un rétrécissement de l'urètre. Bull. Soc. anat. de Par., 1883, 58: 469–482.
76. Uhle, C. W., and Archer, G. F. Primary carcinoma of Cowper's glands. J. Urol., 1935, 34: 128–133.
77. Walther, H. W. Cowper's glands. Oxford Loose-Leaf Living Surgery. Vol. 3, pt. 2, pp. 957–966.
78. Waelsch. Cowperitis gonorrhoica. Handb. d. Geschlechtskr. Leipzig and Wien. 1911. Vol. 6, pp. 850–860.
79. Winslow. Exposé anat. du corps humain. Vol. 4, p. 48.
80. Young, H. H. Practice of Urology. Philadelphia: W. B. Saunders Co., 1926.

THE ELLIOTT TREATMENT AS AN ADJUNCT TO OPERATION IN SIGMOIDAL DIVERTICULITIS

JOHN deJ. PEMBERTON, M.D., F.A.C.S., and JOHN M. WAUGH, M.D., Rochester, Minnesota

IT IS generally accepted among surgeons that the management of diverticulitis of the colon in its surgical phases is a most difficult problem. Especially is this so if the process be complicated by a fistula between the colon and bladder. Dr. W. J. Mayo, in discussing vesicocolonic fistulas, said: "I know of no more trying operations than some of this character." Because of the marked inflammatory reaction which is commonly present in the involved segment of the colon, as well as in the adjacent tissues, primary resection of the affected portion of the bowel cannot usually be safely performed. Therefore, complete diversion of the fecal current by means of a primary colostomy for the purpose of placing at rest the inflamed segment of the bowel is commonly, for reasons of safety, a necessary procedure. By placing the affected segment of the colon at rest for several months, it has been our experience that marked subsidence of the inflammatory reaction usually occurs. In a few instances the subsidence of the inflammation in both the pericolonic tissues and in the colon itself is so complete as to permit the closure of the colonic stoma without inducing a reactivation of the inflammatory process. However, in the great majority of cases the subsidence of the inflammatory process is not complete but is sufficient to permit resection of the affected portion of the bowel. In still another group of cases, fortunately small, there occurs no apparent subsidence of the inflammatory process, even after the bowel has been placed at complete rest for many months. Recently, several months after a colostomy had been performed on a patient with such a condition complicated by a vesicocolonic fistula, during which time there had been little if any subsidence in the size of the inflammatory mass in the pelvis, it occurred to one of us (Pemberton) that heat, applied as in the Elliott treatment, might hasten the absorption of part or all of the tumor and render the affected portion of the intestine more amenable to surgical resection. The result appeared so remarkable and immediate, at least to us, as to warrant the report of the following case.

A man, 53 years of age, first registered at The Mayo Clinic, August 19, 1935, complaining of backache, general malaise, and pyuria. In May, 1934, he had had a severe sore throat with chills, fever, and marked cervical adenopathy. One week later, severe pain had developed over the symphysis and mild dysuria had been noted. Examination of the urine had revealed pus. There had not been any associated pain in the flanks. Since this attack the patient had not been well, but it had been difficult to elicit any specific complaint. No dysuria or pain had been present; the patient had noted only a slight discomfort in the right lumbar region after he had been on his feet for some time. He had lost 20 pounds (9 kilograms). There had been no hematuria, colic, or passage of gravel. About 1 month prior to his admission to the clinic he had noticed the passage of gas from the urethra at the end of micturition, but this phenomenon had disappeared, and at the time he came to the clinic, he had no urinary symptoms except the pyuria, discovered by his physician.

The family and marital histories were without significance. Alcohol was used slightly and tobacco moderately. The previous illnesses had been limited to typhoid fever and tonsillitis. Varicose veins had been treated by injection at intervals during the 3 years before he came to the clinic. He had been subject to slight constipation which had required a cathartic about once a week. There had been no urinary disturbance prior to the one already mentioned, except occasional nocturia.

Physical examination revealed a well developed and well nourished man who did not appear acutely ill. His height was 70½ inches (179 centimeters). His normal weight had been 220 pounds (99.7 kilograms) and his weight at the time of his examination at the clinic was 191 pounds (86.6 kilograms). The values for the blood pressure, expressed in millimeters of mercury, were 128 for the systolic and 85 for the diastolic. The pulse rate was 74 beats per minute and the temperature was 98.4 degrees F. The skin was normal and the pupils reacted to light and accommodation. The teeth were in fair condition and the tonsils were atrophic and scarred. The abdomen was protuberant and tympanitic, no masses or tenderness and no hernia were discernible. Testes were normal. Digital examination of the rectum revealed a normal prostate gland, but a moderately tender, firm mass just above it. The reflexes were normal. A few varicosities were present on both legs.

Examination of the urine did not reveal any abnormality except for pus, graded 1 on a basis of 4; that is about 6 cells to a low power field. There was no growth from a culture on Endo's medium. The flocculation test for syphilis was negative. The value for the hemoglobin was 14.1 grams per 100 cubic centimeters of blood. There were 4,190,000 erythrocytes and 12,400 leucocytes per cubic millimeter of blood. The value for the blood urea was 28 milligrams per 100 cubic centimeters. A roentgenogram of the thorax was normal except for slight torsion of the aorta. A roentgenogram of the kidneys, ureters, and bladder revealed a spina bifida occulta of the last lumbar vertebra and a rounded shadow just off the transverse process of the first lumbar vertebra on the left, which probably was extraurinary. Roentgenoscopic examination of the colon disclosed an obstructing lesion of the sigmoid flexure and perforation, believed to be the result of diverticulitis.

From the Division of Surgery, The Mayo Clinic.

After cystoscopy and examination of an intravenous urogram, the following urologic diagnosis was made. "In the dome of the bladder there is an opening 1 by 1 centimeter in diameter, which is apparently of long standing, as there is no evidence of any inflammatory reaction about it; flocculent material and a bubble of air pass back and forth into this on pressure. Previously it was probably connected with the bowel but now is apparently closed off. There is chronic cicatricial prostatic urethritis (2) with dilated ducts and marked deformity of the prostatic urethra and the bladder."

The proctoscopic examination did not reveal any abnormality except an anal fissure. The bowel was examined for a distance of 22 centimeters above the anus.

The clinical diagnosis was diverticulitis of the sigmoid flexure and obstruction and perforation into the bladder. The patient was advised to submit to exploration to rule out malignancy and because of the possibility that the mass might be resected.

Accordingly, on August 29, 1935, by using a combination of spinal and general anesthesia, exploration was undertaken. The approach was by means of a left rectus incision. A tumor the size of a doubled fist was found involving the midportion of the sigmoid flexure and its mesentery. Part of this mass extended over the dome of the bladder. It seemed definitely to be a diverticulitis. An attempt was made to use the descending colon for a colostomy in the left inguinal region, but this was impossible because it was so near the midline and had practically no mesentery. Accordingly, another small incision was made in the midline in the epigastrium and a loop of transverse colon was brought out as a transverse colostomy.

The colon was opened on the third postoperative day, and except for a very mild bronchopneumonia on the right side, the patient's convalescence was uneventful. He was dismissed September 19, 1935, and advised to return in 3 months for examination and possible resection of the mass.

On January 2, 1936, the patient returned. He had gained about 10 pounds (4.5 kilograms) since his dismissal. There had been no urinary symptoms and no gas had been passed through the urethra. The results of examination were the same as they had been before, and there had been little if any decrease in the size of the hard fixed mass which filled the pelvis above the prostate. Because there had been no subsidence of the mass, it was thought that heat applied in the form of the Elliott treatments per rectum possibly might produce a decrease in size of the inflammatory mass and thus render the involved intestine more amenable to resection.

Accordingly, on January 4, 1936, a rectal applicator was inserted high on the anterior surface of the sigmoid flexure and treatments started with a pressure of 1½ pounds and at a temperature of 127 degrees F. The treatment was continued for 30 minutes. In the course of eight treatments the temperature was gradually increased to 130 degrees F., the pressure was increased to 3 pounds, and the duration of the treatment was increased to 1 hour. These factors were maintained for five treatments; in all, there were 13 treatments. The intervals between the treatments averaged one day. Examination after the eighth application revealed a definite subsidence of the mass, and after the completion of the heat therapy the tumor was about two-thirds its original size.

The patient was sent home and advised to return in about 2 weeks for exploration and resection of the involved intestine or drainage of the abscess, if necessary. On his return the tumor had diminished appreciably in size, and under spinal and general anesthesia exploration was performed on February 10, 1936, through the old left rectus incision. The mass was caused by diverticulitis of the upper portion of the sigmoid flexure, a loop of which had dropped down and was adherent to the superior and posterior surface of the bladder. This adhesion was readily separated by finger dissection and the inflammatory mass, which was less than half its original size, was exteriorized by a Mikulicz procedure. Ten days later, on February 20, 1936, under intravenous anesthesia with pentothal sodium the exteriorized portion of the bowel was removed with the cautery flush with the aponeurosis of the external oblique muscle. There was considerable inflammatory thickening of the spur between the two limbs of the bowel, and it was not deemed advisable to attempt to obliterate the spur until March 16, when one clamp was applied at the site of the exteriorization and another at the site of the transverse colostomy preparatory to closing the stoma in the sigmoid flexure and that in the transverse colon.

Clamps were applied to the spurs on April 23, 1936, May 11, and May 21. The stoma in the sigmoid flexure was closed June 1, 1936, and that in the transverse colon on June 17, 1936. The patient was dismissed from the hospital on June 30 and went home with both wounds healed.

Sydney Jones, in 1859, first recognized and reported accurately the postmortem findings in a case in which colovesical fistula resulted from diverticulitis. His consideration of the pathogenesis of the lesion could not be improved on today. "Probably fecal matter had lodged at the bottom of one of the false diverticula and had produced ulceration, owing to which an abscess was formed external to the bowel, which had eventually communicated with the bladder."

According to W. J. Mayo diverticulosis was present in 5.7 per cent of a series of 31,838 cases in which roentgenological examination was performed at the clinic. Active diverticulitis was present in 696 cases. Most of the patients who revealed roentgenological evidence of diverticulitis were more than 40 years of age and 64 per cent of them were males. This incidence of diverticulosis is about the same as that found at necropsy on patients who belonged to the same age group, by Robertson of the clinic. In a study of 130 cases of diverticulitis H. C. Edwards determined that there were fistulas between the colon and bladder in 3 cases. Adding to these 3 cases, 16 more instances of colovesical fistula obtained from his colleagues, he observed that this complication was five times more prevalent among men than among women and that the ages of the patients ranged from 44 to 69 years, the average being 54 years. H. Lett found colovesical fistula present in 7 of 172 cases of diverticulitis. He determined that this complication was seen once in 10,000 admissions to the hospital; it is undoubtedly rare and more often is a sequel of diverticulitis than of carcinoma. He believed that the position of the uterus between bladder and sigmoid explained the comparative rarity with which these fistulas are found among women.

The patient who has a colovesical fistula usually gives a history of long standing constipation with episodes of abdominal pain which frequently are accompanied by fever. Edwards found the abdominal symptoms to precede the appearance of the fistula by 3 years and 9 months on the average. The symptoms referable to the fistula itself often occur suddenly during an attack of abdominal pain which subsides with the appearance of cloudy and bloody urine accompanied by gas or feces, or both, from the urethra. The amount of gas and feces noticed on micturition varies considerably. Dysuria, urinary frequency and nocturia are usually complained of because of the cystitis which almost invariably is present.

The diagnosis is based on the history of episodes of abdominal pain simulating diverticulitis, the passage of gas or feces, or both, from the urethra, and the cystoscopic findings. H. Lett has well described the various cystoscopic pictures seen in cases of colovesical fistula and classified them in three groups, depending on the stage of the disease. In the first group he included the cases of early involvement with general acute cystitis and a circumscribed red edematous area usually found on the left of the bladder fundus and upper portion of the posterior wall of the bladder. The edema of the mucous membrane of the bladder may be so marked as to throw it into folds and papillomatous projections. The second group includes the fistulas of long standing in which the opening is small so that there is very little cystitis or edema and the small ulcerated region is the only finding. The third group is that in which the fistula has closed and a traction diverticulum has been produced. This is usually obvious and the position is characteristic. There may be slight congestion of the mucous membrane.

The actual demonstration of the fistula by means of the roentgenoscope and barium enema is difficult but should be possible if the opening is of sufficient size. However, in the hands of the expert, a diagnosis of diverticulitis which will explain the findings in the bladder usually is possible by this means. It rarely is possible to find the opening in the bowel by means of the sigmoidoscope but again the presence of diverticulitis may be ascertained and malignancy occasionally may be ruled out.

In spite of the trepidation with which the surgeon attempts to remedy this condition there is fair uniformity in the procedures used by those who have had a considerable experience. W. J. Mayo, Judd, David, Hunt, Abell, and Rankin all advocated preliminary colostomy before attempting to disconnect the vesicocolic fistula or to resect the mass if this proves necessary. After dissecting and suturing the fistulous tract, C. H. Mayo recommended interposing the omentum between the bladder and bowel and around the latter, which is finally sutured to the abdominal wall. It is important, as advised by Lett and Edwards, that the colostomy be of such a type and so situated as completely to sidetrack the fecal stream and put at absolute rest the affected portion of the colon. After this preliminary step, an interval of as long as one year has been recommended to allow the inflammation to subside before attempting repair or excision of the fistula. It is during this interval that the application of heat in the form of the Elliott treatment is advocated and was found to be so efficacious in the case cited. It is our belief that this interval between colostomy and repair or excision of the fistula can safely be shortened to 3 months if the patient undergoes a thorough course of heat treatments and if there is a perceptible decrease in the size of the inflammatory mass as determined by examination. If at the time of the second exploration resection is believed necessary, the Mikulicz type of exteriorization is, if applicable, the ideal procedure. The graded operation is superior because of the lower morbidity and mortality which accompanies it and because there is less danger of contamination resulting in peritonitis than when primary anastomosis of the bowel is attempted at the time of resection.

REFERENCES

1. Abell, Irvin. The diagnosis and treatment of diverticulitis and diverticulosis. Surg., Gynec. & Obst., 1935, 60: 370–377.
2. David, V. C. Diverticulosis and diverticulitis with particular reference to diverticula of the colon. Surg., Gynec. & Obst., 1933, 56: 375–381.
3. Edwards, H. C. Diverticulitis: a clinical review. Brit. M. J., 1934, 1: 973–977.
4. Hunt, V. C. Diverticulosis and diverticulitis of the colon. Calif. & West. Med., 1934, 40: 98–107.
5. Jones, Sydney. Communication between the sigmoid flexure and the bladder, the result of ulceration of a false diverticulum. Tr. Path. Soc. London, 1858–1859, 10: 131–132.
6. Judd, E. S., and Phillips, J. R. Diverticulitis. Surg. Clin. N. America, 1934, 14: 542–548.
7. Lett, Hugh, Nitch, C. A. R., Lockhart-Mummery, J. P., Norbury, L. E. C., Dukes, Cuthbert and Milligan, E. T. C. Discussion on urinary complications of diseases of the large intestine. Proc. Roy. Soc. Med., 1932, pt. 2, 25: 1811–1833.
8. Mayo, C. H. Quoted by Mayo, W. J.
9. Mayo, W. J. Diverticula of the sigmoid. Ann. Surg., 1930, 92: 739–743.
10. Rankin, F. W., and Brown, P. W. Diverticulitis of the colon. Surg., Gynec. & Obst., 1930, 50: 836–847.
11. Robertson, H. E. Quoted by Mayo, W. J.

EDITORIALS

SURGERY
Gynecology and Obstetrics

FRANKLIN H. MARTIN, M.D.
Founder and Managing Editor
1905–1935

ALLEN B. KANAVEL, EDITOR
Associates
LOYAL DAVIS
SUMNER L. KOCH MICHAEL L. MASON

DONALD C. BALFOUR, *Associate, Editorial Staff*

AUGUST, 1937

VIEWPOINTS RELATIVE TO ABDOMINAL SURGERY GYNECOLOGY, AND OBSTETRICS

MEDICAL and surgical specialization should not signify that the qualified specialist in any field limits his knowledge and training to regions. No one realizes this better than the internist and the obstetrician. There are two types of internists—those who care for adults and those who handle children. Of course there are those, such as the neurologist, gastroenterologist, and others, who limit their activities to various systems and regions. These specialists cannot ignore other fields and must consider the patient as an organism in her relationship to the environment. A medical as distinguished from a surgical disorder can hardly remain localized. A condition which is amenable to surgical or operative treatment must be localized though it may have an effect on the whole organism. A gastric ulcer is a local process and becomes at times a surgical disorder; nevertheless, it may, through digestive disturbance and bleeding, produce systemic effects.

In a similar manner the gynecologist may be confronted with a fibromyoma of the uterus which bleeds and produces a marked secondary anemia which can be corrected by removal of the exciting cause. Both the surgeon and the gynecologist are liable to focus attention upon the local condition which they are called upon to treat by mechanical methods. Neither of these specialists deals with physiological processes but with pathological conditions. This does not imply that they are necessarily unfamiliar with physiology, which is an essential part of their intellectual equipment, but it does mean that their daily routine is concerned with abnormal processes.

The obstetrician, on the other hand, constantly is confronted with the physiology of pregnancy, of labor, of the puerperium, and of lactation. The pathological state associated with these processes is present in only a minority of his patients. He therefore has a different viewpoint with reference to his patient who is a woman passing through a physiological process which affects the physiology of all her organs and any one of which may be subject to some disease process at any time.

The surgeon, the gynecologist, and the obstetrician, all should have a common viewpoint with reference to surgical technique. They should all know how to maintain asepsis, control hemorrhage, prevent shock, minimize trauma, and repair injuries. No one can or should practice in any one of these fields without such fundamental knowledge upon which to build the practice of his art. No one should

practice abdominal surgery who does not understand the physiology, pathology, and treatment of diseases of the gastro-intestinal tract. No one should practice gynecology who does not have an adequate, corresponding knowledge of the female generative organs. No physician should practice obstetrics who does not possess the special knowledge of the normal and abnormal processes associated with reproduction. It is equally true that the abdominal surgeon should know the pelvic structures and that the pelvic surgeon should have knowledge at least of the lower abdominal viscera. The obstetrician and gynecologist must be familiar with the vaginal route, which knowledge is not so essential for the abdominal surgeon.

The non-pregnant woman cannot be separated sharply into regions for division among specialties. The pregnant woman presents special problems of both general and local character during pregnancy and especially when in labor. The remote consequences of parturition lead one into the field of gynecology almost constantly, but seldom into abdominal surgery above the pelvic level. Disease of the generative organs frequently affects the reproductive function in some of its activities. These fields of specialization are closely related technically and practically, and from the standpoint of teaching. The capacity of doctors for knowledge and activity varies enormously. One man may be a better abdominal surgeon, gynecologist, and obstetrician, than another is an obstetrician, but as a rule a man works best in the field of his greatest interest, and it is difficult to be equally interested in and informed about all fields. The specialist should maintain his interest in the patient rather than in regions; he should recognize his proficiencies and his deficiencies and be guided by the best interests of the patient rather than by his own.

So far as the named specialties are concerned nothing could be more conducive to the welfare of women than close co-operation in actual practice among those who are skilled in their respective activities. There should be mutual recognition of the rights of patients and the abilities of other specialists. The surgeon or gynecologist or other specialist who delivers a few women annually by cesarean section is probably not equipped to pass judgment upon the desirable procedure for a woman whom he sees in consultation with a general practitioner any more than an obstetrician would be able to decide upon the preferable procedure in an obscure upper abdominal disease requiring surgical intervention.

A specialist and practitioner, recognizing his own limitations and the abilities of others, should be guided by the best interest of the patient in her treatment, seeking the advice and assistance of qualified consultants when their services can be of value to her.

FRED L. ADAIR.

THE RADICAL VERSUS THE MORE CONSERVATIVE ATTITUDE IN THE TREATMENT OF BRAIN TUMORS

IN the surgical treatment of disease, the attitude of the profession has fluctuated constantly between the conservative and the extremely radical. Several factors are responsible for this, and the treatment of many surgical conditions has been affected. Discouraging results have made some radicals conservative, and some conservatives, realizing that they are not securing good results with conservative methods, have resorted to radical methods. Appendicitis, tuberculous glands of the neck, carcinoma of the stomach, gastric and duodenal ulcer, and trigeminal neuralgia

are a few of the conditions in which great changes in treatment have been made within a few years.

One factor that has brought about such changes is the fact that the study of series of cases in which certain methods have been used has shown that the results do not justify the continuance of these methods. A second factor is that the mortality percentage following certain radical procedures may be so great that the surgeon hesitates to continue to use the method. While this may delay progress for years, still some surgeons, even while depressed by poor results, have been so certain they were right that they have persisted and have ultimately triumphed. Billroth, for instance, in 1878 wrote to his former pupil Czerny that of 3 patients upon whom ovariotomies had been performed, 2 had died. He steadfastly continued, however, and a few years later was able to report the good results with which we are all familiar today.

The radical treatment of trigeminal neuralgia, which Hartley and Krause recommended and which gave permanent cure, at first was greeted with great enthusiasm. This enthusiasm rapidly waned, however, because of the prohibitive mortality in the hands of the general surgeon. Twenty years ago the mortality rate given in Keene's *Surgery* was well over 10 per cent. But the patients suffering from *tic douloureux* clamored for permanent relief, and it was through the persistent efforts of Cushing, Frazier, and others, that the operation of section of the posterior root of the gasserian ganglion was put on a new plane. What at first had been a most formidable undertaking has now become a safe procedure, and the mortality rate is extremely low, less than 1 per cent.

At the present time, the neurological surgeon is facing a similar difficulty in another field—that of the surgical treatment of tumors of the brain. How shall such tumors be treated? Before the days of ventriculography, when comparatively few tumors were exposed at operation, the question did not arise. But today, when over 97 per cent of all tumors are exposed at operation, the proper procedure is a problem which each surgeon must face.

Operations to remove tumors of the brain are operations of necessity, not of election—the only way at present to rid a patient of a brain tumor is to remove it, either by surgical excision or possibly by destroying it with radiation by means of radium or deep roentgen ray therapy.

In dealing with brain tumors a number of questions arise that need not be considered in tumors elsewhere in the body. The removal of a brain tumor, even a benign one such as a meningioma, may leave a patient with a permanent disability. After removal of a tumor of the occipital lobe, the patient may be left with an homonymous hemianopsia. When a tumor involving the precentral gyrus is removed, the patient may have a permanent hemiplegia or certainly a hemiparesis. Such disabilities do not follow removal of tumors in other parts of the body. The possibility that such disabilities may occur is an added factor that must be weighed before a decision is reached to remove a brain tumor. It should be kept in mind too that such disabilities may occur irrespective of the type of tumor—they may follow removal of a benign meningioma or of either a malignant or benign glioma.

Gliomas may be divided into three general groups:

1. The well demarcated tumor, even though not encapsulated. In this group belong the astrocytomas, the ependymomas, and the oligodendrogliomas, the three types of slowly growing gliomas which, I think, we have a right to look upon as benign tumors. Some of these tumors may be partially calcified.

2. The radiosensitive tumors—the medulloblastomas.

3. The spongioblastic type. These tumors show a great tendency to recur and must be considered malignant.

There is no disagreement today about the treatment of a benign tumor, even if we know its removal will leave the patient with some disability, such as has been mentioned. In the past few years, however, a curious tendency has developed in regard to the treatment of the spongioblastic tumors—now spoken of as glioblastomas—and the radio-active tumors—the medulloblastomas.

It is a fact well recognized by the neurological surgeon that the exposure of a tumor at operation without removing it, only a decompression being done, greatly increases the immediate mortality of operation. Consequently, when a tumor, even a glioblastoma, is exposed at operation as complete removal as possible should be undertaken to afford the patient temporary relief. The surgeon who believes in the radical procedure will leave a decompression as a safety valve, and then if the tumor recurs he may make another attempt to relieve the patient and try again to eradicate the disease. The conservative surgeon, however, has claimed that no glioblastoma can be cured and therefore that only one operation should be undertaken; that it is better not to do a decompression so that when the tumor recurs the patient will die promptly, thus sparing him a long period of disability and the family much anguish and expense. Others suggest that a certain group of tumors, the medulloblastomas which are radiosensitive, should not be operated upon at all, and without histological confirmation should be treated with deep roentgen-ray therapy, which is acknowledged to be only a palliative procedure.

I cannot subscribe to these points of view, for to do so would be to assume that we have gone as far as we can in the surgical treatment of these conditions; it is an acknowledgment of defeat. To my mind, it is an extension of the euthanasia idea which, though it may be justified in conditions that are definitely hopeless, has no place in any condition in which there are possibilities, even though remote, of curing the patient. Surgical progress would have ceased long ago had this defeatist attitude been followed.

It was my privilege 30 years ago to hear Victor Horsley express himself on this subject. He was asked to see a patient with a pituitary tumor. Up to that time he had operated in very few such cases and had never cured one. He announced that he would operate upon the patient. His colleague remarked, "But the patient will die." His answer was, "Yes, probably, but if I don't undertake it, those who will come after me will not learn to do these cases successfully." This, I take it, is the attitude of the pioneer and the conqueror who is never willing to accept defeat, but keeps on striving for greater things.

Until some new method of treatment is devised, patients with brain tumors can be cured only by having the tumor removed surgically. A few cases of glioblastoma have had no recurrence and are living years later; some patients who had medulloblastomas removed are living and well at the end of 7 to 8 years. The ultimate result in eighth nerve tumors, acoustic neuromas, is better if the tumor is radically removed, even though at present the immediate mortality is greater than when it is incompletely removed by the intracapsular method. This simply means that we must perfect our technique as Billroth perfected his through trial and error to final success.

Progress seems to demand that the radical removal of tumors of the brain is what we should strive for, even though it may not be possible to apply this principle in every in-

stance. If only one patient in perhaps a hundred of these cases can be or has been cured, the possibility that newer or more radical methods may accomplish more must be kept in mind. Following this line of reasoning, in addition to radical extirpations, we have in the past year been giving very large doses of x-ray directly into the operative wound.

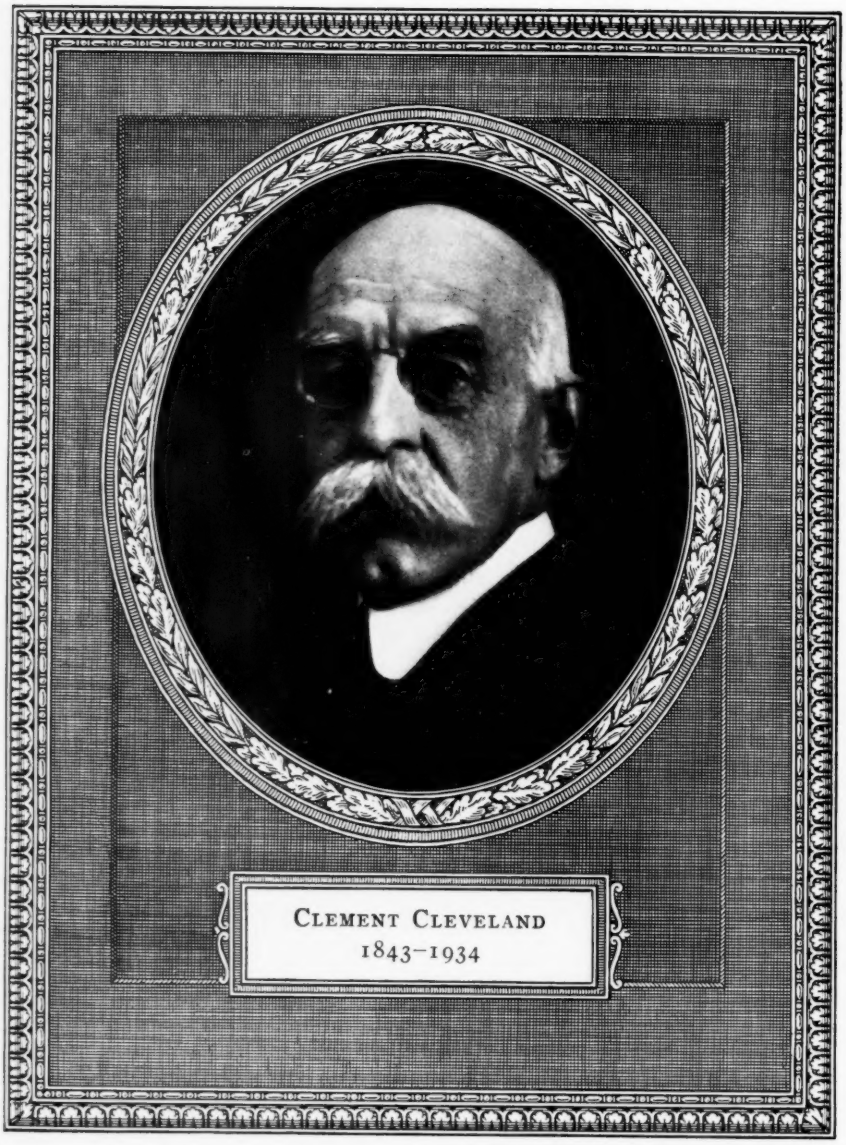
Those who are doing surgical work which is in the nature of pioneer work must carefully weigh the sociological and economic needs against the medical needs. Like Victor Horsley they must weigh the present day results with the good to be derived by future generations. But if they allow the economic and social needs of the patient to influence them too greatly, the desire to press on along a path which at first may not yield results may be set aside. The pioneer spirit, the all consuming wish to make advances and improve results, has characterized the thoughtful, progressive surgeon at all times. ERNEST SACHS.

WORKS OF ART IN MEDICINE AND SURGERY

IT has been suggested by Alexander Woollcott that the Mellon art treasures should not be housed in a formidable museum in Washington where only a few of the fortunate people able to travel can see and enjoy them, but that the pictures be sent on tour, so to speak. It would be his idea to arrange for these valuable and beautiful works of art to be on view in the various cities of the United States in turn. By so doing it would be possible for the largest number of people to see and enjoy them. In other words, Woollcott would not entomb them in a pretentious mausoleum of art in Washington whence one must travel to enjoy them.

The editors of SURGERY, GYNECOLOGY AND OBSTETRICS have realized that the fine engravings of the portraits of historical figures in medicine are not available even in one museum to all of the doctors who are interested and would enjoy seeing them. It seemed practical and worth while to reproduce those masterpieces in this journal from time to time in such a manner that they might be kept and preserved permanently by our readers.

In January, the original engraving by W. Holl of Ambroise Paré was reproduced. In April, the classic painting by E. Hamman of Andreas Vesalius was reproduced from the original lithograph by A. Mouilleron. In this issue, the portrait of John Hunter is reproduced from an engraving by William Sharp of the painting by Sir Joshua Reynolds. All are famous among medical bibliophiles and the collectors of art relating to medicine. We trust that our readers will be interested in preserving these reproductions, as representing a part of the cultural side of surgery. There are many other artistic and historical masterpieces which the Editors hope to make available from time to time.



CLEMENT CLEVELAND
1843–1934

MASTER SURGEONS OF AMERICA

CLEMENT CLEVELAND

ON April 16, 1934, Dr. Clement Cleveland died at his winter home in Florida, having just entered his ninety-first year. Few men have been so vitally active for so long a time, so mentally alert, so interested in life, as he. When the writer of this brief sketch first knew him, forty-three years ago, he looked the athlete that he was—ready for any encounter. Since then, an intimate and uninterrupted association with him showed a mental alertness and development which far outstripped his physical powers. His interest in the practice of his profession was intense, and there was no sacrifice of time or money too great for him to make. His sympathy for rich or poor was unbounded, and its practical application was never wanting. His geniality won him devoted and constant friends and his spirit in the sick room brought comfort, even when hope of life was lost. His personal characteristics were striking and his many scientific attainments of high order.

Dr. Cleveland was born in Baltimore, Maryland, on September 29, 1843, of an old English and New England ancestry. He graduated from Harvard in 1867 with the degree of Bachelor of Arts. He continued his studies at Harvard for his Master's degree and at the College of Physicians and Surgeons for his Medical degree, obtaining the former in 1870 and the latter in 1871. His active medical career began as an interne at the New York City Hospital, from which he received his diploma in 1871. He then became an interne at the Woman's Hospital in the State of New York, receiving his diploma in 1872. From 1874 to 1877, he served the City Hospital as attending surgeon, and from 1882 to 1915 he served as attending surgeon to the Woman's Hospital, followed by 3 years as surgical director. His services were continued in this institution as consulting and emeritus surgeon until his death. He was one of the founders of the Memorial Hospital, known then as the Cancer Hospital, where he served as surgeon for 3 years and as consulting surgeon until his death. It was at this institution that he first became interested in the study of malignant diseases peculiar to women—an interest which led him, with others, to organize the Society for the Control of Cancer.

Dr. Cleveland's scholastic education was at an institution which offered every opportunity to a student that could then be had in this country. He came in contact and was greatly influenced by such men as Wolcott Gibbs, Charles W. Eliot, Andrew Preston Peabody, Oliver Wendell Holmes, and in New York,

where he took his medical degree and early training by Drs. Francis, Barker, Sims, Thomas, Peasley, and others of great fame. His medical classmates and companions, Kinicutt, Bull, and Beverly Robinson, who became as he did, outstanding in their special fields remained his devoted friends throughout their lives.

His apprenticeship at the Woman's Hospital was during the pioneer days of gynecology. There he had the opportunity of seeing the work and of working with the foremost men of that day in this special field. Sixty-three and 24 years before, Ephraim McDowell and Marion Sims, respectively, had blazed the way in major abdominal and plastic surgery. But the full results of their knowledge and skill in allaying the fears of suffering and afflicted women were not realized until the coming of anesthesia and antisepsis. Thomas A. Emmett, Gaillard Thomas, and Edmund R. Peasley followed, adding their surgical techniques and dexterity as priceless contributions to the advancement of gynecology.

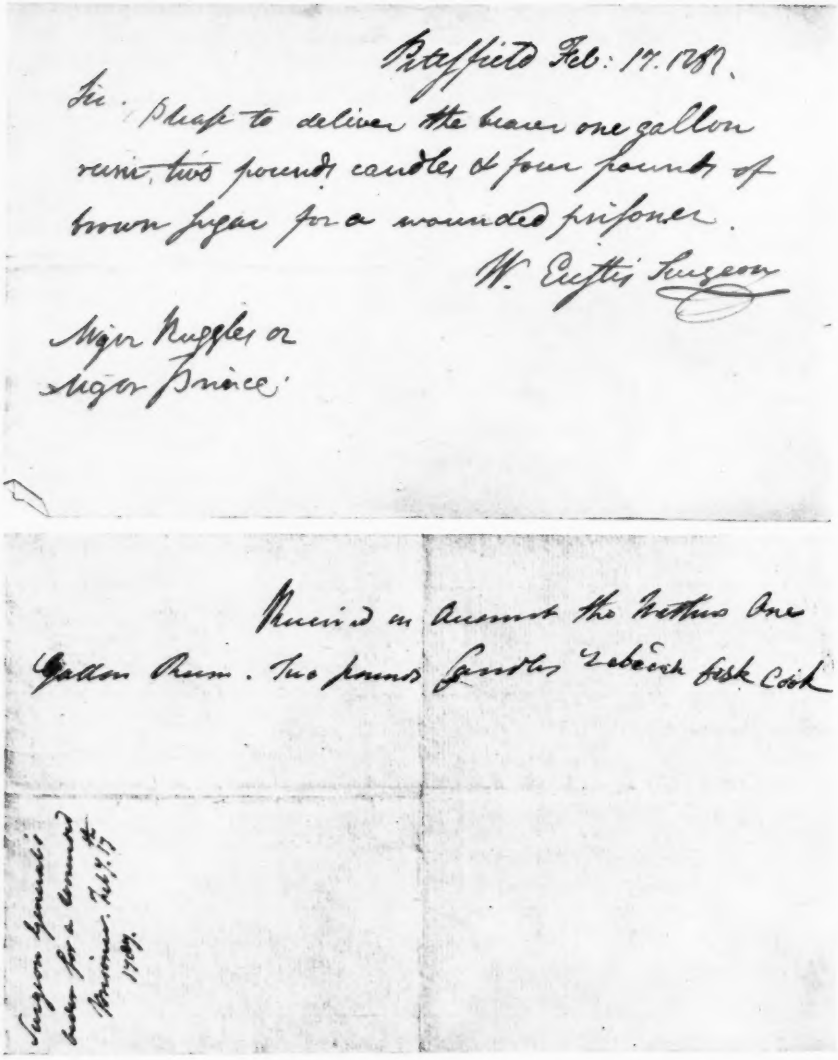
It was in this atmosphere charged with attainments, disappointments, and great hopes—on the very threshold of Lister's great work—that Clement Cleveland was privileged to begin his active surgical career. And of those who started with him, few if any, outstripped him in the race.

Interested in everything pertaining to life and its preservation, and backed by a laudable ambition to vie with his colleagues in service to humanity, he fought his way in his chosen field to an honorable fame. To evaluate him, we must consider his work from the standpoint of scientific mechanics, and from the standpoint of art or individual dexterity; for the time in which he was most active was that of the development of the mechanics of surgery. He became acquainted with bacteriology and pathology chiefly in a practical way, and applied intelligently the knowledge he acquired. His original work in the field of mechanical inventions was recognized in his day, as, for example, his self-retaining speculum, his ligature carrier and adjustable laparotomy table, for which he was awarded a gold medal by the French Government in appreciation of its value in securing the Trendelenburg position. As time passed on, these, with other inventions, were superseded; but they served as stepping stones in the great advance of surgery.

By the recognition of his valuable literary contributions to surgery, by the recognition of his inventive genius in the mechanics of surgery, by the recognition of the many improvements in surgical technique, and for the art in which he executed his work, he was honored many times and in many ways. Among the most conspicuous honors he received, were the presidencies of the New York Obstetrical Society and of the American Gynecological Society, the vice presidency of the Society for the Control of Cancer, a governorship in the American College of Surgeons, and appointments of high trust in noted hospitals in the City of New York.

Dr. Cleveland's social life was that of one surrounded by devoted friends. His acquaintance was extensive and his affiliations with social clubs, notable. He was one of the founders of the Harvard Club of New York City, one of the early members of the University Club, and a member of the Century Club. From these sources he drew many of his early friendships. But as time moved on, Death reaped his harvests, leaving him a lone sentinel until he too fell.

DOUGAL BISSELL.



Pittsfield Feb: 17. 1787.

Sir: Please to deliver the bearer one gallon rum, two pounds candles & four pounds of brown sugar for a wounded prisoner.

W. Eustis Surgeon

Major Ruggles or
Major Prince.

Received on account the Bottles One Gallon Rum. Two pounds Candles Rebeick Fisk Cook

Surgeon General's order for a Gallon Rum for a wounded Prisoner. Feb. 17. 1787.

Facsimile of Surgeon General's order for supplies for a wounded prisoner, dated February 17, 1787, and signed by William Eustis, later Secretary of War in President Madison's cabinet.

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

IN *Bright's Disease and Arterial Hypertension*[1]—a well bound and well printed volume of 352 pages—the author has tried to correlate and clarify "the various opinions experienced in the enormous literature on the subject." Dr. Stone has been keeping notes on the course and progress of patients with Bright's disease for 20 years and he presents the autopsy reports on 140 cases after a general review and discussion of the literature. The author comments that one of the main reasons why divisions of renal disease into "parenchymatous" and "interstitial" groups "endured so much longer than the terminology merited was because of its simplicity. In the study of patients with Bright's disease, physicians are in many cases ignorant of the etiological sequences but are relatively secure in their conceptions based upon long observation of the clinical course of the disease." The author then groups the problem into: (1) Acute Bright's disease—hemorrhagic and degenerative. (2) Chronic Bright's disease—arteriosclerotic with primary hypertension; hemorrhagic with secondary hypertension; and degenerative without hypertension. The reviews of the physiology of kidney function, water balance, edema, acidosis, and uremia are especially well done. The best of the late work has been drawn upon in an attempt to develop the subject.

The second half of the book lacks some of the force of the first half and Dr. Stone's discussion brings out great gaps in our understanding of Bright's disease; the reader is impressed with the great need of further work even though great progress has been made in the past 10 years. This volume should be of definite help to the majority of physicians who treat Bright's disease.

M. HERBERT BARKER.

INASMUCH as the last edition of Keyes' *Urology* appeared in 1928, many improvements have occurred in the diagnosis and treatment of genito-urinary disease. The new edition[2] has been entirely rewritten to embrace the changed concepts of the character of disease, modern diagnosis and therapy, namely: intravenous urography, prostatic resection, calculogenesis, tuberculosis, tumors, and irradiation therapy. The number of illustrations has been doubled. The book largely represents the senior author's experience, while the comments on pathology, irradiology, endocrinology, and tumors, are almost exclusively the junior author's.

On controversial topics, the student is referred to the discussions of various international and national societies.

The table of contents has been amplified and rearranged from its original 2½ pages to 11½ pages. This is a much needed improvement. The index of necessity has been enlarged, and the many new words and expressions indicate the number of changes in urology in a scant 10 years.

The term "achalasia" has almost completely replaced the word "sclerosis" in reference to the vesical neck. Avitaminosis, hyperparathyroidism, prolan A and the rôle of other endocrine substances are new subjects in this volume. "Atony of the bladder," neglected for some time, is again included.

Formerly it was stated categorically that the urinary tract was entirely aseptic: now—emphatically *no*. It is eminently infectable. The introduction of less harmful contrast media in pyelography has removed the former dangers of bilateral simultaneous pyelograms. The cystometer is believed a misleading weapon except in expert hands.

Heat therapy in the treatment of gonorrhea is fully discussed. "Fever therapy, though by no means always successful, is specific and requires no supporting systemic or local treatment of the gonorrhea." The conclusions are: "In the present state of our knowledge, heat therapy is too uncertain in its results as well as too prostrating, too dangerous, too expensive for use in any but the most unusual circumstances."

The progress in our knowledge of the pathological physiology and diagnosis of tumors of the testicle is excellent.

In discussing transurethral prostatic resection, the hand of the senior author can be plainly seen. He discusses with his usual candor and humor the status of this popular controversial procedure. In effect, it is an operation which the average urologist will never do well. Naturally, in such a textbook, the beginner should be properly advised. Transurethral resection should be done only by the expert. The authors favor the two stage suprapubic operation, and for small prostates, resection by the best method learned at a successful clinic. The application of resection for carcinoma of the prostate is mentioned but not stressed.

The reviewer and his colleagues have used Keyes' *Urology* as a standard textbook in teaching medical students for many years. We find the new edition by Keyes and Ferguson vastly superior in every

[1] BRIGHT'S DISEASE AND ARTERIAL HYPERTENSION. By Willard J. Stone, B.Sc., M.D., F.A.C.P. Philadelphia and London: W. B. Saunders Co., 1936.

[2] UROLOGY. By Edward L. Keyes, Ph.D., F.A.C.S., F.R.C.S. (Hon. Eng.), and Russell S. Ferguson, A.B., M.D. 6th ed. New York and London: D. Appleton-Century Co., 1936.

detail. It will not be held against the authors that "cheerfulness has occasionally crept in" to a subject long dour and depressing. L. L. VESEEN.

TO encompass in a single volume the entire field of surgery, even that portion required of undergraduate students, is a most difficult task and one that requires careful selection of material, brevity, and accuracy. The presentation must be systematic in order to be adapted to classroom work. Less common phases of clinical surgery must necessarily be omitted. It is the opinion of the reviewer that these conditions have been ably met in the *Textbook of General Surgery*[1] by Cole and Elman. Approximately one-third of the volume is taken up with "general surgery" or surgical principles, including such subjects as surgical bacteriology, surgical infections, tumors, wounds, and kindred topics. This phase of the text is particularly well presented and illustrated. Chapters on the breast, thoracic cage, bile tracts, and intestinal tract are worthy of special mention. The authors have purposefully and wisely not dealt at any great length with surgical procedure and technique.

The only criticism the reviewer has to make is on the inclusion of chapters on gynecology and urology. It would seem unnecessary to include such material in a present day text on general surgery. The choice and excellence of illustrations throughout the volume are deserving of special mention.

J. R. BUCHBINDER.

[1] TEXTBOOK OF GENERAL SURGERY. By Warren H. Cole, M.D., F.A.C.S., and Robert Elman, M.D. New York and London: D. Appleton-Century Co. Inc., 1936.

CORRESPONDENCE

MOYNIHAN MEMORIAL FUND

To the Editor: The Board of the General Infirmary at Leeds realize that the greatest memorial to the genius and work of the late Lord Moynihan must always be advancement in the Art of Surgery which he did so much to promote. They feel, however, that it is their duty and privilege to perpetuate a record of Lord Moynihan's work for surgery and his labors in and for the General Infirmary at Leeds by the erection within its walls of a suitable memorial. Already a ward has been named the "Moynihan Ward," but much more than this is clearly required.

The Board have appointed a committee to submit and carry out a suitable scheme, and on behalf of this committee I am able to state that the sum of £750 has already been received. More than this is needed if the memoria is to be adequate, and I am authorized to invite subscriptions from medical and lay sympathizers. It is suggested that one guinea would be an appropriate amount, though more or less would be very acceptable.

Subscriptions should be forwarded to the General Infirmary at Leeds in the name of the "Moynihan Memorial Fund" or to myself. They will all be very gratefully acknowledged.

CARLTON OLDFIELD, Chairman,
Moynihan Memorial Fund.

25A Park Square, Leeds, England.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

EUGENE H. POOL, New York, *President* FREDERIC A. BESLEY, Waukegan, *President-Elect*
VERNON C. DAVID, *Chairman;* MICHAEL L. MASON, *Secretary, Committee on Arrangements*

PRELIMINARY PROGRAM FOR THE 1937 CLINICAL CONGRESS IN CHICAGO

THE surgeons of Chicago, under the leadership of a representative committee, will provide a program of clinics and demonstrations for the twenty-seventh annual Clinical Congress of the American College of Surgeons in Chicago, October 25–29, that will present a complete showing of the clinical activities in all departments of surgery in this great medical center.

A preliminary schedule of the operative clinics and demonstrations, as prepared by the committee, appears in the following pages. Published in tentative form at this time the clinical program will be revised and amplified during the months preceding the Congress. It will be noted that clinics are being arranged for the afternoon of Monday, October 25, and for the mornings and afternoons of each of the four following days.

In addition to an ample and well arranged schedule of operative clinics that will demonstrate the technique of a wide variety of surgical procedures, the committee is arranging a series of demonstration clinics at the medical schools and in the larger hospitals to present the work being done in many special fields, including neurosurgery, traumatic surgery, thoracic surgery, plastic surgery fractures, cancer, orthopedics, gynecology and obstetrics, genito-urinary surgery, experimental urgery, physical therapy, roentgenology, etc.

The committee is assured of the hearty co-operation of the clinicians at the five medical schools and more than fifty hospitals that will participate in the clinical program.

So that the visiting surgeon may be assured of an opportunity to devote his time continuously, if he wishes, to clinics dealing particularly with those special subjects in which he is most interested, the committee has undertaken to correlate the programs of the participating institutions planning to arrange so that fracture clinics or cancer clinics, for example, will be available each morning and afternoon during the five days of the Congress.

An extensive schedule of operative clinics and demonstrations at the hospitals and schools is being prepared by the subcommittee on ophthalmology and otolaryngology. In addition programs are being prepared for two evening sessions at the Stevens Hotel at which visiting ophthalmologists and otolaryngologists will present and discuss papers of interest to those who specialize in these particular fields.

As they so faithfully depict clinical features of major interest to surgeons, the showing of surgical motion picture films will be continued at this year's session with an enlarged program of both sound and silent pictures to be exhibited daily at headquarters.

EVENING SCIENTIFIC MEETINGS

Programs for a series of evening sessions are being prepared by the Executive Committee of the Board of Regents. A preliminary outline of these programs will be found on a following page.

At the opening session, the presidential meeting and the convocation, in the ballroom of the Stevens Hotel on Monday evening, the address of welcome will be given by Dr. Vernon C. David, chairman of the committee on arrangements, following which a number of distinguished foreign guests will be introduced.

Dr. Eugene H. Pool, of New York, retiring president, will deliver the presidential address, followed by the inauguration of the new officers—Dr. Frederic A. Besley, of Waukegan, president; Dr. Frank W. Lynch, of San Francisco, and Dr. Austin B. Schinbein, of Vancouver, vice-presidents. At this session the 1937 class of initiates will be received into fellowship in the College. The annual college oration on surgery will be

delivered by J. P. Lockhart-Mummery, M.B., B.Ch., F.R.C.S., of London, England.

At sessions on Tuesday, Wednesday and Thursday evenings, addresses on surgical subjects of special importance will be presented by outstanding surgeons of the United States and Canada. A preliminary outline of these programs will be found on a succeeding page.

AFTERNOON SESSIONS

A cancer symposium on Tuesday afternoon, under the auspices of the Committee on the Treatment of Malignant Diseases, will deal not so much with organization and administrative problems as with scientific and clinical phases of the cancer problem. Figures on five-year cures of cancer being compiled by the Department of Clinical Research from statistics furnished by surgeons, pathologists, and radiologists as individuals or as members of hospitals and clinics, will be presented at this conference. These, added to the 24,440 five-year cures reported by the College in 1934, should provide a basis for increasing hopefulness of cancer control on the part of the public as well as of the surgeon.

The conference on graduate training for surgery to be held at 2:00 o'clock on Wednesday, the program for which appears on a succeeding page, will be of interest to all Fellows of the College since it is one related to the requirements for fellowship. A need for consideration of the various aspects of this subject, to be participated in by prominent surgeons and representatives of other interested organizations, has long been felt. The field staff of the College has for six years been collecting and recording information on the opportunities for graduate training provided in hospitals, particularly the larger ones, and this data together with findings from a 1937 survey of hospitals made by a special field representative will be reported. In a panel discussion there will be presented the viewpoints of the surgeons in the teaching hospital, the large non-teaching hospital and the rural community hospital, on graduate training. The findings and viewpoints of the American Medical Association, the American Surgical Association, the American Board of Surgery and others will be presented and discussed with a view to correlating all available information and experience on the subject of the opportunities now open and those which should be provided for the graduate student.

A symposium on obstetrics and gynecology is also scheduled for Wednesday afternoon. Papers of interest to the general surgeon as well as to the specialist in these fields will be presented by well known authorities. Significant of what some surgeons today believe is a noticeable trend is the subject of the first paper, "Conservatism in Obstetrics."

Thursday afternoon will be devoted to a conference on industrial medicine and traumatic surgery. Subjects discussed will be of special interest to surgeons who are in the field of industrial medical service, but also come within the scope of general surgery since the injuries suffered by the workman are often the same as or similar to those experienced by the autoist, pedestrian, or mere onlooker in this mechanical age. The appalling number, variety, and severity of injuries, which almost any surgeon is called upon to treat, demand increasing attention to development of better methods and techniques. Results of the year's surveys will be reported by the Committee on Industrial Medicine and Traumatic Surgery under whose auspices this symposium will be held.

Surgeons in industry as well as those in general practice will be interested in the Friday afternoon program to be presented by the Committee on Fractures. Newly developed methods of dealing with fractures, and their results, will be described by surgeons who have had wide experience with this type of injury.

Further exposition of the various phases and subjects of industrial medicine and traumatic surgery, cancer, and fractures, will be given in clinics and in demonstrations in various Chicago hospitals during the Congress. The scientific exhibits at headquarters will also include many items appertaining to these subjects.

HOSPITAL CONFERENCE

The twentieth annual hospital standardization conference of the College (see program in the following pages) will consist of morning and afternoon sessions from Monday, at 10:00 a.m., to Wednesday noon at the Stevens Hotel, including a joint session with the Chicago Hospital Association and the Chicago Hospital Council on Tuesday evening, demonstrations in various Chicago hospitals on Wednesday afternoon, sessions Thursday morning and afternoon at the headquarters hotel, and inspection trips to Chicago hospitals on Friday.

Dr. Eugene H. Pool, of New York, president of the College, will address the opening session. Dr. George Crile, of Cleveland, chairman of the Board of Regents, will present the report of the 1937 survey of hospitals and the official announcement of the approved list. There will also be presented at this session addresses dealing with the obligations of the hospital, consideration of personality

and psychology factors, selection of hospital personnel, and effects of hospital insurance plans.

"The Medical Staff Conference" will furnish the general theme for the Monday afternoon session. Following a discussion of the subject in its various aspects the medical staff of the Ravenswood Hospital of Chicago will stage a demonstration of a model conference.

Addresses at the Tuesday morning session will be on the general theme of the clinical departments of the hospital, and at the afternoon session on the management of hospital personnel.

"Public Relations" will be the general theme of the Tuesday evening joint session, at which Charles H. Schweppe, president of the Chicago Hospital Council, will preside. The subject will be discussed from the viewpoints of the press, the hospital administrator, the hospital trustee, and the member of the medical staff. Methods of raising funds will be considered. The importance of winning and keeping community good will will be stressed.

The Association of Record Librarians of North America will meet in joint session with the conference on Wednesday morning. Following a discussion of methods of record keeping and the value of complete medical records, a sketch, "The Medical Record Librarian's Dream Comes True," will be presented by the Medical Record Librarians of Chicago. Through this dramatization it will be shown how an interested medical staff can facilitate and make more useful to themselves, their patients, and the public, the work of the medical record librarian.

Sixteen Chicago hospitals and the University of Chicago Clinics will co-operate with the conference by providing on Wednesday afternoon demonstrations of many phases of hospital administration and operation. Delegates may at the time they register make a selection of the demonstrations they wish to attend.

Problems of hospital administration and standardization will be discussed in a round table conference and in addresses at the Thursday morning and afternoon sessions.

Friday will be devoted to visits to hospitals in Chicago and vicinity. Help in selecting these will be given delegates at headquarters for hospital registration and information.

HEADQUARTERS AND TECHNICAL EXHIBITION

Headquarters for the Congress will be established at the Stevens Hotel where the grand ballroom with its large foyers and other meeting-rooms on the second and third floors have been reserved for scientific sessions and conferences.

The Technical Exhibition will be located in the Exhibition Hall in which will be placed the registration and clinic ticket bureaus and the bulletin boards on which the daily clinical program will be posted each afternoon for the following day. Leading manufacturers of surgical instruments, x-ray apparatus, operating room lights, hospital apparatus and supplies of all kinds, ligatures, dressings, pharmaceuticals and publishers of medical books will be represented.

ADVANCE REGISTRATION

The hospitals and medical schools of Chicago afford accommodations for a large number of visiting surgeons, but to insure against overcrowding, attendance at the Congress will be definitely limited to a number that can be comfortably accommodated at the clinics, the limit of attendance being based upon the result of a survey of the amphitheaters, operating rooms, and laboratories of the hospitals and medical schools to determine their capacity for visitors. Therefore, those surgeons who wish to attend the Congress should register in advance.

A registration fee of $5.00 is required of each surgeon attending the annual Clinical Congress, such fees providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued, which receipt is to be exchanged for a general admission card upon his registration at headquarters. This card, which is non-transferable, must be presented in order to secure clinic tickets and admission to the evening meetings.

Admittance to clinics and demonstrations will be controlled by means of special clinic tickets, the number of tickets issued for any clinic being limited to the capacity of the room in which that clinic is given. This plan provides an efficient means for the distribution of the visiting surgeons among the several clinics and insures against overcrowding.

RAILWAY RATES

Surgeons living in the western and southwestern states and the western portion of the southeastern states who plan to attend the Clinical Congress in Chicago may purchase round-trip tickets to Chicago with a 30-day return limit on the basis of two cents per mile in each direction for transportation in Pullman cars not including the Pullman charge. From certain points in the south Atlantic coast states (southeastern territory) round-trip tickets with a 15-day return limit will be sold on the basis of two cents per mile in each direction

to Central Passenger Association gateways, plus three cents per mile in each direction from such gateways to Chicago. Round-trip tickets at low rates will be available from points in the Pacific coast states.

In the territory east of Chicago, north of the Ohio and Potomac rivers, including the north Atlantic and New England states and eastern provinces of Canada the regular rate of three cents per mile in Pullmans and two cents per mile in coaches will be in effect.

Complete information as to rates, routes and stopover privileges may be obtained from local ticket offices.

CHICAGO HOTELS AND THEIR RATES

In addition to the headquarters hotel, the Stevens, there are several first-class hotels within short walking distance of headquarters, providing ample hotel facilities at reasonable rates. It is suggested that reservation of hotel accommodations be made at an early date. The following hotels are recommended by the Committee:

	Minimum Rate with Bath	
	Single	Double
Auditorium, 430 S. Michigan Ave.	$2.50	$4.00
Bismarck, 171 W. Randolph St.	3.50	5.00
Blackstone, Michigan Ave. at 7th St.	4.00	6.00
Congress, 500 S. Michigan Ave.	3.00	5.00
Drake, Michigan and Lake Shore Drive	4.00	6.00
Great Northern, 237 S. Dearborn St.	2.50	4.00
Harrison, 57 E. Harrison St.	2.50	3.50
Knickerbocker, 163 E. Walton Pl.	3.00	5.00
LaSalle, 10 N. LaSalle St.	3.00	4.50
Morrison, 79 W. Madison St.	3.00	4.00
Palmer House, 15 E. Monroe St.	3.50	5.00
Sherman, 106 W. Randolph St.	2.50	4.00
Stevens, 720 S. Michigan Ave.	3.00	4.50

PROGRAMS FOR AFTERNOON SESSIONS

CONFERENCE ON GRADUATE TRAINING FOR SURGERY

Wednesday, 2:00 P.M.

FREDERIC A. BESLEY, M.D., Waukegan, Ill.; President, American College of Surgeons, presiding.

Opening Remarks. GEORGE CRILE, M.D., Cleveland; Chairman, Board of Regents, American College of Surgeons.

Purpose of Conference. MALCOLM T. MACEACHERN, M.D., Chicago; Associate Director, American College of Surgeons.

Graduate Training for Surgery. ALTON OCHSNER, M.D., New Orleans.

Findings from the 1937 Survey of Hospitals by the American College of Surgeons. MELVILLE H. MANSON, M.D., Minneapolis; Special Field Representative.

Panel Discussion from the following viewpoints:

The Surgeon in the Teaching Hospital. DALLAS B. PHEMISTER, M.D., Chicago.

The Surgeon in the Large Non-Teaching Hospital. DONALD GUTHRIE, M.D., Sayre, Pa.

The Surgeon in the Rural Community Hospital. HOWARD L. SNYDER, M.D., Winfield, Kan.

The American Surgical Association. EUGENE H. POOL, M.D., New York.

The American Board of Surgery. EVARTS A. GRAHAM, M.D., St. Louis.

The American Medical Association. FRED W. RANKIN, M.D., Lexington, Ky.

Essentials in Graduate Training for Surgery. LOUIS B. WILSON, M.D., Rochester, Minn.

Discussion: Otolaryngology, PERRY G. GOLDSMITH, M.D., Toronto; Urology, FRANK HINMAN, M.D., San Francisco; Gynecology and Obstetrics, ARTHUR H. CURTIS, M.D., Chicago.

OBSTETRICAL AND GYNECOLOGICAL CONFERENCE

Wednesday, 2:00 P.M.

FRANK W. LYNCH, M.D., San Francisco; Vice-President, American College of Surgeons, presiding.

Conservatism in Obstetrics. GEORGE W. KOSMAK, M.D., New York.

Water Balance in Relation to Toxemias of Pregnancy. M. EDWARD DAVIS, M.D., Chicago.

Pelvic Pain—Its Significance and Treatment. ARTHUR H. CURTIS, M.D., Chicago.

Cesarean Section. JOHN R. FRASER, M.D., Montreal.

Syphilis in the Pregnant Woman. JAMES R. MCCORD, M.D., Atlanta.

PROGRAMS FOR EVENING MEETINGS

Presidential Meeting and Convocation—Monday, 8:00 P.M.—Ballroom, Stevens Hotel

Address of Welcome. VERNON C. DAVID, M.D., Chicago, Chairman, Committee on Arrangements.
Introduction of Foreign Guests.
Address of the Retiring President. EUGENE H. POOL, M.D., New York.
Inauguration of Officers.
Conferring of Fellowships. FREDERIC A. BESLEY, M.D., Waukegan, Illinois.
Conferring of Honorary Fellowships. The President.
Annual Oration on Surgery: The Surgeon as a Biologist. J. P. LOCKHART-MUMMERY, M.B., B.Ch., F.R.C.S., London.

Tuesday, Wednesday and Thursday, 8:00 P.M.—Ballroom, Stevens Hotel

Nucleus Pulposus and Lower Back and Sciatic Pains. HOWARD C. NAFFZIGER, M.D., San Francisco.
Symposium on Lymphedema:
The Genesis and Consequences of Lymphedema. CECIL K. DRINKER, M.D., Boston.
Circulatory and Lymphatic Disturbances in the Abdomen. WILLIS D. GATCH, M.D., Indianapolis.
Diverticula of the Intestine. CLAUDE F. DIXON, M.D., Rochester, Minnesota.
Immediate or Delayed Treatment of Acute Cholecystitis (Liver-Shock and Death). HENRY W. CAVE, M.D., New York.
Tuberculosis of the Kidney. FRANK HINMAN, M.D., San Francisco.
Physiological and Pathological Changes in the Urinary Tract during Pregnancy. J. MASON HUNDLEY, JR., M.D., Baltimore.
Acute Pancreatitis. IRVIN ABELL, M.D., Louisville.
Fracture Oration. WILLIAM O'NEILL SHERMAN, M.D., Pittsburgh.

Community Health Meeting—Friday, 8:00 P.M.—Ballroom, Stevens Hotel

Program in preparation.

ANNUAL HOSPITAL STANDARDIZATION CONFERENCE

Monday, 10:00—Ballroom, Stevens Hotel

EUGENE H. POOL, M.D., New York; President, American College of Surgeons, presiding.
President's Address.
Report of the 1937 Survey of Hospitals and Official Announcement of the Approved List. GEORGE CRILE, M.D., Cleveland; Chairman, Board of Regents, American College of Surgeons.
The Approved Hospital and Its Obligation—Diagnosis and Therapy, Education, Prevention and Research. BERT W. CALDWELL, M.D., Chicago.
Personality and Psychology in the Hospital. G. HARVEY AGNEW, M.D., Toronto.
Criteria to be Observed When Selecting Internes and Residents. JAMES H. MEANS, M.D., Boston.
The Effect Hospital Insurance Plans Are Having on Medical and Hospital Services. C. RUFUS ROREM, Ph.D., Chicago.

Monday, 2:00—Ballroom, Stevens Hotel

GEORGE E. WILSON, M.B., Toronto; Vice President, American College of Surgeons, presiding.
The Medical Staff Conference—with Panel Discussion from the Following Viewpoints:
General Presentation of Subject. HAROLD L. FOSS, M.D., Danville, Pa.
Proper Attitude of the Medical Staff. JAMES T. NIX, M.D., New Orleans.
Time, Place and Physical Essentials. WILLIAM H. WALSH, M.D., Chicago.
Conduct of the Conference. EDWARD L. TUOHY, M.D., Duluth, Minn.
Criteria of a Good Medical Staff Conference. FELIX P. MILLER, M.D., El Paso, Texas.
Demonstration—A model medical staff conference by the medical staff of Ravenswood Hospital, Chicago.

Tuesday, 10:00—Stevens Hotel

E. WELDON YOUNG, M.D., Seattle, Wash., presiding.
Clinical Departments of the Hospital, Embracing Organization, Direction, Control, Functioning.
Oral Surgery and the Dental Department in the General Hospital. WILLIAM H. G. LOGAN, M.D., Chicago.
Psychiatric Department in the General Hospital. SAMUEL W. HAMILTON, M.D., New York.
The Physical Therapy Department in Small, Medium and Large General Hospitals. JOHN S. COULTER, M.D., Chicago.

The Out-patient Department in the General Hospital. CHRISTOPHER G. PARNALL, M.D., Rochester, N. Y.
The Obstetrical Department in the General Hospital. OTTO H. SCHWARZ, M.D., St. Louis.

Tuesday, 2:00—Stevens Hotel

FRED G. CARTER, M.D., Cincinnati, presiding.
Hospital Personnel Management—with Panel Discussion from Various Viewpoints:
General presentation of subject. FRANK J. WALTER, Denver.
Selection. E. MURIEL ANSCOMBE, R.N., St. Louis.
Physical Health. HAROLD L. SCAMMELL, M.D., Halifax, N. S.
Assignment of Duties. CLINTON F. SMITH, Chicago.
Working and Living Conditions. JOSEPH G. NORBY, Milwaukee.
Morale. MACIE N. KNAPP, R.N., Normal, Ill.
Training and Education of Hospital Personnel. GEORGE O'HANLON, M.D., Jersey City, N. J.

Tuesday, 8:00 p.m.—Stevens Hotel

Joint Session—with Chicago Hospital Association and Chicago Hospital Council. CHARLES H. SCHWEPPE, Chicago, presiding.
Public Relations—with Panel Discussion from the Following Viewpoints:
General presentation of subject. PERRY ADDLEMAN, Chicago.
The Hospital Administrator. ADA BELLE MCCLEERY, R.N., Evanston, Ill.
The Member of the Medical Staff. FREDERIC J. COTTON, M.D., Boston.
Fund Raising. D. ALLAN CRAIG, M.D., Torrington, Conn

Wednesday, 10:00—Stevens Hotel

Joint Session—with Association of Record Librarians of North America. R. C. BUERKI, M.D., Madison, Wis., presiding.
Developing a Medical Record Consciousness in the Hospital. SISTER M. PATRICIA, O.S.B., B.S., R.R.L., Duluth, Minn.
What Constitutes a Proper Appraisal of the Medical Record. CHARLES B. PUESTOW, M.D., Chicago, and LILLIAN H. ERICKSON, R.R.L., Milwaukee.
Incomplete Medical Records—Causes and Remedies. ALICE G. KIRKLAND, R.R.L., Oakland, Calif.
The Remunerative Value of Good Medical Records. RICHARD B. DAVIS, M.D., Greensboro, N. C.
The Technique of Making Group Studies of Diseases. THOMAS R. PONTON, M.D., Chicago.
Sketch—The Medical Record Librarian's Dream Comes True. Presented by the Medical Record Librarians of Chicago.

Wednesday, 2:00

Demonstrations in the following Chicago hospitals: Chicago Memorial, Children's Memorial, Cook County, Grant, Henrotin, Michael Reese, Passavant Memorial, Presbyterian, Ravenswood, Research and Educational, St. Elizabeth's, St. Joseph's, St. Luke's, St. Mary of Nazareth, University of Chicago Clinics, Wesley Memorial, West Suburban.

Thursday, 10:00—Stevens Hotel

Panel Round Table Conference—Pertinent Problems Relating to Hospital Administration and Hospital Standardization. Conducted by ROBERT JOLLY, Houston, Texas, and R. C. BUERKI, M.D., Madison, Wis.
Call Systems for Hospitals. JOHN GORRELL, M.D., Grand Rapids, Mich.
Administrative Problems of the Small Hospital. GLADYS BRANDT, R.N., Logansport, Ind.
Nursing Service. SISTER MARY LIDWINA, Chicago.
Medical Social Service Standards. BABETTE JENNINGS, Chicago.
Air-Conditioning in Hospitals. PERRY W. SWERN, Chicago.
Hospital Income. BRYCE L. TWITTY, Dallas, Texas.
Technical Service Standards in the Hospital. CLAUDE W. MUNGER, M.D., New York.

Thursday, 2:00—Stevens Hotel

Standardization of Hospital Furnishings, Equipment and Supplies. L. M. ARROWSMITH, Brooklyn.
Food Service. MIRIAM C. CONNELLY, Baltimore.
Professional Problems of the Small Hospital. MARY E. SKEOCH, R.N., Marquette, Mich.
Nursing Education. MARY M. ROBERTS, R.N., New York.
Out-patient Department. FREDERICK MACCURDY, M.D., New York.
The Cancer Clinic in the General Hospital. FRANK E. ADAIR, M.D., New York.
The Hospital Pharmacy. EDGAR C. HAYHOW, Paterson, N. J.
The Front Office of the Hospital. LEE C. GAMMILL, Little Rock, Ark.

Friday

An opportunity will be afforded the hospital delegates to visit Chicago hospitals. Special information pertaining to each institution will be available at the hospital registration and information desk.

PRELIMINARY CLINICAL PROGRAM

ARRANGED IN THE FOLLOWING SUBDIVISIONS: GENERAL SURGERY, GYNECOLOGY AND OBSTETRICS, GENITO-URINARY SURGERY, FRACTURES AND TRAUMATIC SURGERY, PLASTIC AND FACIOMAXILLARY SURGERY, NEUROSURGERY, THORACIC SURGERY, TUMORS AND IRRADIATION, ROENTGENOLOGY, PHYSICAL THERAPY, EXPERIMENTAL SURGERY, OPHTHALMOLOGY, OTOLARYNGOLOGY

GENERAL SURGERY

Monday Afternoon

CHICAGO MEMORIAL HOSPITAL

CHARLES J. DRUECK, SR., GEORGE L. BROOKS, OTTO SAPHIR and GEORGE LANDAU. Symposium: Carcinoma of the rectum, carcinoma of the colon.

CHARLES E. KAHLKE, GEORGE L. BROOKS, OTTO SAPHIR and GEORGE LANDAU. Symposium: Peptic ulcer.

PASSAVANT MEMORIAL HOSPITAL

SUMNER L. KOCH, MICHAEL L. MASON and HARVEY S. ALLEN. Surgery of the hand: Dupuytren's contracture, Von Volkmann's contracture, nerve and tendon suture, burn contractures of the hand and plastic repair with skin grafts, chronic tenosynovitis.

ST. ANTHONY DE PADUA HOSPITAL

R. C. DRURY. Spinal anesthesia.

ST. BERNARD'S HOSPITAL

R. J. FASIO. Blood transfusion, merits of accepted methods.

WOMEN AND CHILDREN'S HOSPITAL

CLEMENTINE FRANKOWSKI and HELEN M. KOSTKA. Varicose veins, treatment by injection and by ligation.

Tuesday Morning

AUGUSTANA HOSPITAL

N. M. PERCY. Operations.

ALBERT MERRITT BILLINGS HOSPITAL

Clinical Demonstrations

LESTER R. DRAGSTEDT and staff. Clinical and experimental studies in gastric and duodenal ulcer.

WALTER L. PALMER, F. E. TEMPLETON and RUDOLF SCHINDLER. X-ray and gastroscopic studies of gastric ulcer under medical treatment.

A. BRUNSCHWIG. Pancreatoduodenectomy for carcinoma of the head of the pancreas.

H. P. JENKINS. Abdominal wound disruptions and the durability of catgut sutures.

CHICAGO MEMORIAL HOSPITAL

CHARLES E. KAHLKE. Stomach surgery.

CHARLES J. DRUECK, SR. Surgery of the colon and rectum.

COOK COUNTY HOSPITAL

KARL A. MEYER, R. H. JAFFE, M. J. HUBENY, AARON ARKIN and RUDOLF SCHINDLER. Symposium: Surgery of the stomach. Operations.

DR. GATEWOOD. Children's surgery.

GEORGE G. DAVIS, ALBERT H. MONTGOMERY, JOHN HARGER, HARRY JACKSON and JOHN G. FROST. Operations.

Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine, 427 S. Honore Street.

EVANGELICAL DEACONESS HOSPITAL

EDWARD N. HEACOCK. Cholecystectomy.

GARFIELD PARK HOSPITAL

EDMUND FOLEY, PAUL SCHMITT, HAROLD WAIT, SAMUEL PLICE, CLAUDE WELDY and FRED DESTEFANO. Symposium: Gall-bladder disease.

HOLY CROSS HOSPITAL

V. F. TORCZYNSKI. Cholecystectomy; appendectomy; hysterectomy.

M. J. BADZMIEROWSKI. Thyroidectomy, 5 cases; cholecystectomy.

J. P. DYBALSKI. Cholecystectomy, 3 cases; nephrectomy; hysterectomy.

A. J. MANIKAS. Appendectomy.

JACKSON PARK HOSPITAL

G. M. LUCAS. Clinic.

W. MORLEY SHERIN. Gall-bladder surgery.

Symposium: Appendicitis

A. BAMBERGER. Surgical aspect.

R. R. JAMIESON. Medical aspect.

J. J. MOORE. Pathological aspect.

LUTHERAN DEACONESS HOSPITAL

JOHN D. KOUCKY, G. H. MAMMEN and GEORGE H. SCHROEDER. Operations.

MERCY HOSPITAL

Dry Clinic

C. F. SAWYER and associates. Unusual causes of intestinal obstruction; partial and complete gastrectomy.

M. MCGUIRE and associates. Pelvic appendicitis; obstructive jaundice.

MOUNT SINAI HOSPITAL

V. SCHRAGER. Operations.

J. GAULT. Technique of high internal saphenous vein ligation.

P. KAPLAN. Demonstration of tubulovalvular gastrostomy.

PRESBYTERIAN HOSPITAL

KELLOGG SPEED, ALBERT H. MONTGOMERY, DR. GATEWOOD and associates. Operations.

V. C. DAVID, C. B. DAVIS and E. M. MILLER. Dry clinics and symposia.

RAVENSWOOD HOSPITAL

Dry Clinic

P. J. SARMA. Varicose veins; ligation and obliterative treatment.

R. E. DYER. End-results of gastro-enterostomies, demonstration of cases.

D. B. POND and R. F. GREENING. Treatment of osteomyelitis.

J. J. MOORE. Tumors of breast.

D. L. JENKINSON. X-ray interpretations.

GEORGE DE TARNOWSKY. Exstrophy of bladder.

C. J. GEIGER. Ectopic ureter and absence of vagina; cervical carcinomas.
M. W. FIELD. Obstetric practice by general practitioner.
W. F. GROSVENOR. Toxemia in pregnancy.
W. C. HAMMOND. Endometriosis.

MICHAEL REESE HOSPITAL

D. C. STRAUS. Thyroid operations.
RALPH B. BETTMAN and WILLIAM TANNENBAUM. Gallbladder surgery.
A. A. STRAUSS. Gastro-intestinal surgery.
JAMES PATEJDL. Operations.
P. SHAPIRO. Operations.

Symposium: Gastro-intestinal diseases

A. A. STRAUSS. Surgical treatment of peptic ulcer.
S. STRAUSS. Pre- and postoperative care of the ulcer patient.
JAMES PATEJDL. Perforating ulcer, surgical treatment.
JACOB MEYER. Medical care of the ulcer patient.

Symposium: Carcinoma of the rectum

A. A. STRAUSS. Surgical.
S. STRAUSS. Surgical diathermy; after care and results of surgical diathermy.
M. APPEL. Histiocytic variation in cancer tissue.
GUSTAV KOLISHER. History of surgical diathermy.
OTTO SAPHIR. Pathology of the rectum following surgical diathermy.

RESEARCH AND EDUCATIONAL HOSPITALS

GEZA DETAKATS. Lumbar sympathectomy operation.

Symposium: Neurocirculatory Diseases

R. BRUNNER. The use of neosynephrine in spinal anesthesia.
WILLIAM C. BECK. Selection of cases for sympathectomy: demonstration of sympathectomized patients; evaluation of results; management of lymphedema.
F. K. HICK. Vascular accidents associated with coronary occlusion.
H. C. LUETH. Unusual reactions following the use of nitroglycerine.
GEZA DETAKATS. Treatment of acute arterial occlusion; operability of hypertension; demonstration of cases.
P. J. SARMA and H. L. MISHKIN. The treatment of varicose veins and ulcers.
J. T. REYNOLDS. Amputations in peripheral vascular disease.

ST. ANTHONY DE PADUA HOSPITAL

JOSEPH ZABOKRTSKY. Operations.

ST. BERNARD'S HOSPITAL

J. T. MEYER, E. J. MEYER and R. J. MEYER. Thyroidectomy.
W. G. EPSTEIN and M. MENNITE. Abdominal surgery and differential diagnosis of acute abdominal adhesions.

ST. JOSEPH'S HOSPITAL

WILLIAM C. BECK. Thoracic surgery.
AUSTIN A. HAYDEN. Conservation of hearing; mastoid and sinus surgery.
ARCHIBALD HOYNE. Control of contagion in surgical diseases.
WILLIAM H. G. LOGAN. Oral surgery.
FRANKLIN B. MCCARTY. Gall-bladder surgery.
CHARLES M. MCKENNA. Undescended testicle.
HUGH MCKENNA. Fractures: Conservative surgery in diabetic gangrene.
FRANK THEIS. Peripheral circulatory diseases.

Pathological and radiological material illustrating the above will be presented by LAWRENCE HINES, pathologist, and WILLIAM E. ANSPACH, radiologist.

ST. MARY OF NAZARETH HOSPITAL

GEORGE MUELLER. Regional ileitis.

VETERANS ADMINISTRATION FACILITY

PAUL F. BROWN. Operations.

WASHINGTON BOULEVARD HOSPITAL

ARTHUR R. METZ. General surgery and fractures.

WESLEY MEMORIAL HOSPITAL

R. W. MCNEALY, EMORY STRAUSER and F. L. HUSSEY. Gastric surgery.

Tuesday Afternoon

CHICAGO MEMORIAL HOSPITAL

BENNETT R. PARKER. Thyroid surgery.

COOK COUNTY HOSPITAL

EDWARD J. LEWIS. Operations.

HOLY CROSS HOSPITAL

M. J. BADZMIEROWSKI. Pre- and postoperative treatment of thyroid disease.

JACKSON PARK HOSPITAL

HARRY E. L. TIMM. Operations.

MERCY HOSPITAL

C. L. MARTIN. Symposium: Rectal neoplasms and inflammations.
J. E. KELLEY. The hernia problem.

PASSAVANT MEMORIAL HOSPITAL

J. R. BUCHBINDER, A. C. IVY and ARTHUR BYFIELD. Symposium on the biliary tract.

MICHAEL REESE HOSPITAL

Dry Clinic

NATHAN CROHN. The use and abuse of the injection treatment of hernia; suitable and unsuitable cases, methods.
LEO ZIMMERMAN. Surgical treatment of direct inguinal hernia.
RUDOLF SCHINDLER. The use of the gastroscope and its value to the surgeon.
SAMUEL GOLDBERG. Pooled human convalescent serum treatment of surgical streptococcus hemolyticus infections.
JAMES PATEJDL. Congenital duodenal obstruction in newborn; duodenal diverticuli causing clinical symptoms.

Dry Clinic

LEO ZIMMERMAN. Diseases of veins.
PHILIP SHAPIRO. Recent advances in the treatment of varicose veins.
BERNARD PORTIS. Embolism of the peripheral arteries.
SAMUEL PERLOW. Surgical measures used in the treatment of peripheral circulatory disturbances; differentiation between arterial and arteriolar spasticity as an aid in the selection of cases for sympathetic ganglionectomy.

ST. LUKE'S HOSPITAL

GEZA DETAKATS, GEORGE SOUPHAM, GEORGE K. FENN, CARL JOHNSON and RICHARD CAPPS. Surgery of cardiovascular diseases.

ST. MARY OF NAZARETH HOSPITAL

P. DORETTI and T. PLANT. Abdominal operative clinic.

VETERANS ADMINISTRATION FACILITY

PAUL F. BROWN. Symposium: Stomach surgery.

WOMEN AND CHILDREN'S HOSPITAL

Management of Diseases Complicating Surgery

CAROLYN MACDONALD. Syphilis.
ROSE MENENDIAN. Endocrine disorders.
RUTH RENTER DARROW. Diabetes.

Wednesday Morning

AUGUSTANA HOSPITAL

A. T. LUNDGREN, EARL GARSIDE, R. J. E. ODEN and J. W. NUZUM. Operations.

CHICAGO MEMORIAL HOSPITAL

PETER S. CLARK, VANCE RAWSON, GEORGE LANDAU and OTTO SAPHIR. Gall-bladder symposium.
LEO M. ZIMMERMAN and RICHARD E. HELLER. Fundamental problems in the surgical treatment of inguinal hernia; modern management of varicose veins.

CHILDREN'S MEMORIAL HOSPITAL

A. H. MONTGOMERY, J. IRELAND, J. GRAHAM, W. POTTS, A. DIGGS and J. MUSSIL. Operations and demonstration of cases.

COLUMBUS HOSPITAL

D. A. ORTH and E. NORA. Bone and joint tuberculosis; peritonitis; Rollier treatment.

COOK COUNTY HOSPITAL

RAYMOND W. MCNEALY, MANUEL LICHTENSTEIN, FREDERICK TICE, RICHARD H. JAFFE and M. J. HUBENY. Symposium: Diseases of the gall bladder.
RAYMOND W. MCNEALY, VICTOR SCHRAGER, GEORGE L. APFELBACH, ROGER T. VAUGHAN and MARSHALL DAVISON. Operations.

Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine, 427 S. Honore Street.

EVANSTON HOSPITAL

Symposium: Colon Surgery

L. D. SNORF. Diagnosis.
E. R. CROWDER. Roentgenology.
E. L. BENJAMIN. Pathology.
FREDERICK CHRISTOPHER. Surgery.
W. R. PARKES. Prognosis in malignancy.

Dry Clinic

MARCUS HOBART. Operative treatment of low back pain.
JAMES GRIER. Common bile duct obstructions.
W. K. JENNINGS. Prevention of recurrence in femoral hernia operations.

HOLY CROSS HOSPITAL

CHARLES M. MCKENNA. Cholecystectomy: herniorrhaphy.
J. F. DYBALSKI. Open reduction of fracture of femur.
F. KRAFT. Hysterectomy; perineorrhaphy.
F. SALETTA. Hysterectomy; perineorrhaphy; operation for shortening round ligament.
M. STRIKOL. Appendectomy; herniorrhaphy.

JACKSON PARK HOSPITAL

ARRIE BAMBERGER. Pre- and postoperative treatment of surgical cases.
C. C. CLARK and H. HOYT COX. Operations.

LUTHERAN DEACONESS HOSPITAL

GEORGE O. SOLEM. Surgical indications in peptic ulcer.

MOTHER CABRINI HOSPITAL

EUGENE J. CHESROW and ALBERT J. CHESROW. Operations.
E. P. OLIVIERI and N. V. EMANUELE. Demonstration clinic.

MOUNT SINAI HOSPITAL

E. I. GREENE. Anaerobic hemolytic streptococcus infection (Meleney's disease).
JACOB M. MORA. Thyroidectomy in the aged.
D. WILLIS. Removal of foreign (metallic) bodies from tissues with aid of a new instrument.
J. M. GREENE. Acute intestinal obstruction.
I. TRACE. Postoperative pulmonary complications with special reference to massive pulmonary collapse.
M. L. ARKIN. The surgical diabetic.
L. EDIDIN and N. I. FOX. Medicosurgical discussion.
L. FELDMAN. Streptococcic bacteriemia precipitated by surgical procedures.

MUNICIPAL TUBERCULOSIS SANITARIUM

CLEMENT L. MARTIN. Anorectal tuberculosis.
MAX THOREK. Surgery in tuberculous patients.

POSTGRADUATE HOSPITAL

EMIL RIES. Episacro-iliac lipomas with backache.

PRESBYTERIAN HOSPITAL

V. C. DAVID, KELLOGG SPEED, C. B. DAVIS, DR. GATEWOOD, E. M. MILLER, A. H. MONTGOMERY and associates. Operations.

MICHAEL REESE HOSPITAL

M. L. PARKER, LEO ZIMMERMAN and SAMUEL GOLDBERG. Operations.
B. PORTIS. Thyroid surgery.
SAMUEL PERLOW. Peripherovascular surgery.
A. A. STRAUSS, S. STRAUSS and J. PATEJDL. Gastro-intestinal surgery.
RALPH B. BETTMAN and WILLIAM TANNENBAUM. Gall-bladder operations.

Dry Clinic: Surgery of the Gall Bladder

SAMUEL SOSKIN. The preparation of the liver for surgery.
R. A. ARENS. The technique of cholecystography.
A. M. SERBY, S. PORTIS and G. LICHTENSTEIN. The evaluation of liver function tests; gall-bladder diet; survey of postoperative results of the gall-bladder group.
RALPH B. BETTMAN, LEO ZIMMERMAN and WILLIAM TANNENBAUM. Motion picture and diagrammatic demonstrations: The technique of cholecystectomy, choledocostomy, choledochogastrostomy or enterostomy.

RESEARCH AND EDUCATIONAL HOSPITALS

W. H. COLE. Thyroidectomy; operation for pyloric obstruction.
P. J. SARMA and H. L. MISHKIN. Clinic on varicose veins.

Symposium: Diseases of the Thyroid

W. H. COLE. Pre-operative care and postoperative complications.
C. B. PUESTOW. Use of silk in thyroidectomy.
L. SEED and R. BRUNNER. Blood pressure studies during thyroidectomy.
J. M. MORA. Hepatic damage in hyperthyroidism.
R. W. KEETON. Cardiac complications of hyperthyroidism.
W. H. COLE. Tracheal collapse.
JOHN HOWE. The thyroid gland as observed at autopsy in patients with diseases other than hyperthyroidism.
J. H. BAILEY. Bacteriological studies in the operating room.

ST. ANNE'S HOSPITAL

THOMAS E. MEANY. Fractures and tendon transplantations.
JOHN L. KNAPP and JOHN W. KEANE. Surgical clinic, demonstration of cases.
GEORGE F. THOMPSON. Surgical clinic, demonstration of cases.

ST. ANTHONY DE PADUA HOSPITAL

S. E. Donlon and H. P. Sullivan. Operations and demonstration of cases.

ST. BERNARD'S HOSPITAL

G. M. Cushing. The surgical treatment of perforated gastric ulcer.

ST. LUKE'S HOSPITAL

H. E. Jones, Will Lyon, William R. Cubbins and associates. Operations.

U. S. MARINE HOSPITAL

O. E. Nadeau. Results in hernia surgery.
E. C. Lutton and R. W. Flynn. Spinal anesthesia demonstration.

WESLEY MEMORIAL HOSPITAL

William Miller. Review of gall-bladder surgery.

FRANCES E. WILLARD HOSPITAL

Victor L. Schrager. Clinic.

WOMEN AND CHILDREN'S HOSPITAL

Pearl M. Stetler. Abdominal surgery.

Wednesday Afternoon

COLUMBUS HOSPITAL

D. A. Orth, C. J. Scheribel and E. D. Nora. Experimental thyrotoxicosis.
J. L. Spivack. Valve operation.

MICHAEL REESE HOSPITAL

Symposium

Samuel Perlow. Paravertebral alcohol injections for the relief of cardiac pain.
Leo Zimmerman and Otto Saphir. Benign tumors of the thyroid gland.
Samuel Goldberg. Acute mesenteric lymphadenitis; strangulated hernias in premature infants.
Thomas J. Merar. Rectal complications of lymphogranuloma inguinale.
Casper Epstein. Fractures of the jaws.
M. L. Parker. Carcinoma of the large bowel.

ST. ANNE'S HOSPITAL

Harry J. Dooley. Urological clinic, demonstration of cases.
John J. Gearin and E. P. Gramer. Surgical clinic, demonstration of cases.

ST. BERNARD'S HOSPITAL

Herman DeFeo. The medical management of cholecystic diseases.
B. C. Cushway and associates. Roentgen studies of gall-bladder diseases.
S. L. Governale. Cholecystotomy versus cholecystectomy.
Chester Guy. Pathology of the gall bladder.

ST. LUKE'S HOSPITAL

S. W. McArthur and associates. Bile tract and colon surgery.

WESLEY MEMORIAL HOSPITAL

Guy S. Van Alstyne. Abdominal surgery.

FRANCES E. WILLARD HOSPITAL

Louis F. Plzak. Clinic.

Thursday Morning

AUGUSTANA HOSPITAL

N. M. Percy. Operations.

CHICAGO MEMORIAL HOSPITAL

Peter S. Clark, Leo M. Zimmerman and M. L. Weinstein. Gall-bladder surgery.

COOK COUNTY HOSPITAL

Richard H. Jaffe. Pathological conference.
Karl A. Meyer, George G. Davis, Albert H. Montgomery and Max Thorek. Operations.
Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine, 427 S. Honore Street.

EVANGELICAL DEACONESS HOSPITAL

John I. Perl. Stomach resection.

HOLY CROSS HOSPITAL

J. Francis Ruzic. Choledochotomy and dilatation of common duct; vaginal hysterectomy; cholecystectomy.
J. Francis Ruzic, D. DiCiro and Walter Eisen. Resection of superior hypogastric ganglion.
D. DiCiro. Kidney neoplasm.
Francis Streysman. Varicocelectomy.
John Simonaitis. Pelvic laparotomy.

ILLINOIS MASONIC HOSPITAL

Charles Drueck. Pruritus ani—cases due to systemic disturbances: Ovarian dysfunction (vicarious pruritus); hypothyroidism; spastic colon; obesity.

JACKSON PARK HOSPITAL

George M. Lucas. Operations.

LUTHERAN DEACONESS HOSPITAL

John D. Koucky, G. H. Mammen and George H. Schroeder. Operations.

MERCY HOSPITAL

L. D. Moorhead. Symposium: Goiter.

PASSAVANT MEMORIAL HOSPITAL

Paul Starr. Symposium: Diseases of the endocrine glands.

PRESBYTERIAN HOSPITAL

V. C. David, C. B. Davis, William Miller and associates. Operations.
Kellogg Speed, Dr. Gatewood and A. H. Montgomery. Dry clinics and symposia.

MICHAEL REESE HOSPITAL

A. A. Strauss and S. Strauss. Gastro-intestinal surgery.
D. C. Straus. General surgery.

Thyroid Symposium

D. C. Straus. Group study and demonstration of thyroid records; surgical management of hyperthyroidism.
S. Soskin. The endocrine disturbance in thyroid disease.
L. N. Katz. Disturbed physiology of the cardiovascular system in thyroid disease.
M. Lev. Some clinical aspects of the heart in hyperthyroidism; medical management of hyperthyroidism.
A. S. Bohning and L. N. Katz. The electrocardiogram in thyroid disease.
W. W. Hamburger. Arrhythmias in thyroid disease.

B. PORTIS. Outpatient clinic management of hyperthyroidism.
B. PORTIS and H. ROTH. Treatment of hyperthyroidism complicated by pregnancy and syphilis.
R. LEVINE. Experimental treatment of hyperthyroidism.

RESEARCH AND EDUCATIONAL HOSPITALS

C. B. PUESTOW. Operations: Choledochostomy; carcinoma of rectum.

Symposium: Gall-Bladder Diseases

C. B. PUESTOW. The effect of cholecystectomy on pressure in the choledochus; gall-bladder fistulæ.
EDMUND FOLEY. Differential diagnosis between intrahepatic and extrahepatic jaundice.
W. H. COLE. The role of cystic duct obstruction to gall-bladder disease.
A. HARTUNG. The advantage of combining gastro-intestinal series with cholecystography.

ST. ANTHONY DE PADUA HOSPITAL

F. B. OLENTINE. Operations and demonstration of goiter and abdominal surgery cases.

ST. JOSEPH'S HOSPITAL

WILLIAM C. BECK. Thoracic surgery.
AUSTIN A. HAYDEN. Conservation of hearing; mastoid and sinus surgery.
ARCHIBALD HOYNE. Control of contagion in surgical diseases.
WILLIAM H. G. LOGAN. Oral surgery.
FRANKLIN B. MCCARTY. Gall-bladder surgery.
CHARLES M. MCKENNA. Undescended testicle.
HUGH MCKENNA. Fractures; conservative surgery in diabetic gangrene.
FRANK THEIS. Peripheral circulatory diseases.
Pathological and radiological material illustrating the above will be presented by LAWRENCE HINES, pathologist, and WILLIAM E. ANSPACH, radiologist.

ST. MARY OF NAZARETH HOSPITAL

J. C. HILL. Pathologic discussion of operative findings.
T. LARKOWSKI. Symposium: Hernias and their repair.

VETERANS ADMINISTRATION FACILITY

PAUL F. BROWN. Operations.

WESLEY MEMORIAL HOSPITAL

R. W. MCNEALY and associates. Surgery of jaundiced patients.
GUY S. VAN ALSTYNE. Carcinoma of the breast; combined surgical and x-ray treatment.

FRANCES E. WILLARD HOSPITAL

A. E. STEWART. Clinic.

WOMEN AND CHILDREN'S HOSPITAL

PEARL M. STETLER and MARIE ORTMAYER. Gastro-intestinal clinic; gastroscopic technique.
ALICE CONKLIN. Thyroidectomy.
ESTHER RAHN. Repair of ventral hernia.

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL

BENNETT R. PARKER, LEO M. ZIMMERMAN, WALTER S. PRIEST, OTTO SAPHIR and GEORGE M. LANDAU. Symposium: Thyroid disease.
FRANK WRIGHT, ALBERT ZRUNEK, LEO M. ZIMMERMAN, M. L. WEINSTEIN and OTTO SAPHIR. Symposium: Blood transfusion.

COOK COUNTY HOSPITAL

RALPH B. BETTMAN and EDWARD J. LEWIS. Operations.

HOLY CROSS HOSPITAL

J. FRANCIS RUZIC. Biliary tract surgery.

MICHAEL REESE HOSPITAL

Symposium: Gastro-Intestinal Surgery

LEON BLOCH. The medical treatment of ulcerative colitis.
A. A. STRAUSS. The surgical management of ulcerative colitis.
S. STRAUSS. The use of ileostomy in ulcerative colitis and carcinoma of the colon.
OTTO SAPHIR. Pathology of ulcerative colitis. Discussion.
R. ARENS. X-ray diagnosis of ulcerative colitis and peptic ulcer. Discussion.
A. A. STRAUSS and H. F. BINSWANGER. Medical and surgical treatment of terminal ileitis.

RESEARCH AND EDUCATIONAL HOSPITALS

Symposium: Diseases of the Gastro-Intestinal Tract

GEORGE MILLES. Pathology of carcinoma of stomach.
W. H. COLE. Total gastrectomy.
T. J. WACHOWSKI. X-ray diagnosis of carcinoma of stomach.
C. L. BIRCH. Anemia associated with total gastrectomy.
M. H. STREICHER. Diagnosis of carcinoma of the rectum.
C. B. PUESTOW. Surgical treatment of carcinoma of the rectum.
BERNARD PORTIS. Surgical treatment of complicated duodenal ulcers.
F. L. MCMILLAN. Regional ileitis.
J. L. SPIVACK. Tubovalvular stoma with particular reference to gastrostomy.
H. O. WERNICKE. The injection treatment of herniæ.

ST. ANTHONY DE PADUA HOSPITAL

W. H. BRADLEY. Operations.

ST. BERNARD'S HOSPITAL

W. S. HECTOR and S. S. DUBOVY. Imperforate anus with atresia of large bowel.

ST. MARY OF NAZARETH HOSPITAL

A. PARTIPILO. Aseptic gastro-intestinal anastomosis.
P. CZWALINSKI. Surgical incisions.
F. TENOZAR. Abdominal operations.

WESLEY MEMORIAL HOSPITAL

E. B. PERRY and H. E. E. BARNARD. Abdominal surgery.

FRANCES E. WILLARD HOSPITAL

OTIS M. WALTER. Clinic.

WOMEN AND CHILDREN'S HOSPITAL

EMELIA GIRYOTAS. Cholecystectomy.

Friday Morning

ALBERT MERRITT BILLINGS HOSPITAL

Presentation on Surgery and the Circulation

H. LIVINGSTONE. Anesthesia and the circulation.
N. ROOME, H. WILSON, H. N. HARKINS and D. B. PHEMISTER. Studies in causes and treatment of surgical shock.
W. E. ADAMS. Intrathoracic operation and the circulation.

COLUMBUS HOSPITAL

M. J. SEIFERT and F. X. O'MALLEY. Gastro-intestinal surgery.

COOK COUNTY HOSPITAL

DR. GATEWOOD. Children's surgery.
RALPH C. SULLIVAN, VERNON C. DAVID, HARRY JACKSON and FRANK J. JIRKA. Operations.
Members of the surgical staff will give demonstrations in surgical technique upon cadavers and dogs in the laboratories of the Graduate School of Medicine, 427 S. Honore Street.

HOLY CROSS HOSPITAL

FRANK FRAIDER and NICHOLAS PAVLETIC. Hysterectomy; cesarean section; cholecystectomy.
STEPHEN BIEZIS. Cholecystectomy; hysterectomy; repair of incisional hernia.
FELIX WINSKUNAS. Inguinal herniorrhaphy.
JAMES GALLAGHER. Cholecystectomy.
WILLIAM REILLY. Cholecystectomy and appendectomy.
M. J. BADZMIEROWSKI and H. IRACE. Hysterectomy.

ILLINOIS MASONIC HOSPITAL

CHARLES H. PARKES, CARL F. STEINHOFF and WALTER C. BORNEMEIER. Surgical diabetes—organization of the service for the care of the surgical diabetic where an intimate relationship exists between the surgeon and the internist which is greater than that of a consultation; review of cases on service for past ten years; presentation of treatment involved in surgical diabetes, protomine insulin; anesthesia; operative and postoperative cases, lower extremity.
JOHN R. HARGER and JOHN H. GILMORE. Gall-bladder surgery—history building: Personal history in detail, laboratory findings and practical values of various tests; x-ray, development to date in this diagnostic field; demonstration of operative technique with use of peridural route for anesthesia in the cases, discussion of advantages of peridural anesthesia over spinal and lessening of hazard; greater satisfaction than with any type of general.

JACKSON PARK HOSPITAL

ARRIE BAMBERGER, H. HOYT COX and C. CLARK. Operations.

LUTHERAN DEACONESS HOSPITAL

JOHN D. KOUCKY, G. H. MAMMEN and GEORGE H. SCHROEDER. Operations.
GEORGE O. SOLEM. Surgical indications in peptic ulcer.

MOUNT SINAI HOSPITAL

A. A. STRAUSS, S. F. STRAUSS and B. SAYRE. Operations.
M. LEWISON. Surgery in patients with cardiovascular diseases.
H. J. ISAACS. Coronary disease simulating acute abdominal catastrophies.
E. B. FRELICH. Surgery in tuberculosis.
I. DAVIDSOHN. Clinical pathological conference.

PASSAVANT MEMORIAL HOSPITAL

SAMUEL J. FOGELSON. Experimental surgical problems.

POSTGRADUATE HOSPITAL

L. ZIMMERMAN. Varicose veins and their complications.

PRESBYTERIAN HOSPITAL

V. C. DAVID, KELLOGG SPEED, C. B. DAVIS, DR. GATEWOOD, WILLIAM MILLER and A. H. MONTGOMERY. Operations.

MICHAEL REESE HOSPITAL

J. PATEJDL, P. SHAPIRO, R. CRAWFORD, B. PORTIS, S. GOLDBERG, M. L. PARKER and LEO ZIMMERMAN. Operations.

RESEARCH AND EDUCATIONAL HOSPITALS

R. B. MALCOLM. Operative clinic: Neck dissection; carcinoma of breast; surgical pathology of breast tumors.
Clinical Demonstration
T. J. WACHOWSKI. X-ray treatment of carcinoma of the breast.
ARRIE BAMBERGER. Ewing tumor with case report.
S. R. ROSENTHAL. The toxin and antitoxin of burns.
W. H. COLE. Acute pancreatitis.

ST. ANTHONY DE PADUA HOSPITAL

J. J. SPRAFKA. Abdominal surgery and demonstration of cases.

ST. ELIZABETH'S HOSPITAL

E. D. KALZELAGE. Thyroid disease.

ST. LUKE'S HOSPITAL

E. W. HIRSCH, E. JENKINSON and staff. Staff clinic.

WESLEY MEMORIAL HOSPITAL

EARL LATIMER. Unusual breast tumors.

Friday Afternoon

COOK COUNTY HOSPITAL

J. G. FROST. Operations.
SUMNER L. KOCH. Surgery of the hand.
E. H. WARSZEWSKI. Operations.

HOLY CROSS HOSPITAL

CHARLES GALANTI. Osteogenic sarcoma.
EMIL WEISS. Splenomegaly.

JACKSON PARK HOSPITAL

HARRY E. L. TIMM. Operations.

MOUNT SINAI HOSPITAL

I. DAVIDSOHN. Differential diagnosis of infectious mononucleosis simulating surgical conditions; demonstration of technique.

ST. BERNARD'S HOSPITAL

J. M. MAHONEY. Infective granuloma of the cecum simulating a neoplasm; case demonstration.

ST. ELIZABETH'S HOSPITAL

J. K. NARAT. Pre- and postoperative intravenous administration of fat emulsion.

Days to be Announced

COOK COUNTY HOSPITAL

VICTOR L. SCHRAGER. Symposium: Appendicitis.
SUMNER L. KOCH. Symposium: Hand infections.
HARRY JACKSON. Symposium: Skull fractures.
EDWIN M. MILLER. Symposium: Children's surgery.
FREDERICK G. DYAS. Symposium: Peritonitis.
MARSHALL DAVISON. Symposium: Diseases of the thyroid gland.
VERNON C. DAVID. Symposium: Surgery of the large bowel.

HENROTIN HOSPITAL

JOHN A. GRAHAM. Demonstration clinic.

GYNECOLOGY AND OBSTETRICS

Monday Afternoon

CHICAGO LYING-IN HOSPITAL

FRED L. ADAIR and staff. Motion picture demonstration of cesarean section.

COOK COUNTY HOSPITAL

FREDERICK H. FALLS. Operations.
A. F. LASH. Puerperal sepsis; ward walk.

HOLY CROSS HOSPITAL

PAUL LAWLER. Application of obstetrical forceps (manikin demonstration).

ILLINOIS MASONIC HOSPITAL

HAROLD W. MILLER and WALTER BORNEMEIER. Ovarian cysts; uterine fibroids. Dry clinic for demonstration of cases and general discussion; operation during which use and value of peritoneoscope will be demonstrated.
F. O. BOWE and BEULAH WALLIN. Cesarean section: Indications, comparison of results in different types, demonstration of operative technique of low cesarean section.

ST. BERNARD'S HOSPITAL

E. A. RACH and F. J. STUCKER. Cesarean section.

WOMEN AND CHILDREN'S HOSPITAL

ANNIE E. BLOUNT. Operations.

Tuesday Morning

CHICAGO LYING-IN HOSPITAL

FRED L. ADAIR, WILLIAM J. DIECKMANN, M. EDWARD DAVIS, H. C. HESSELTINE and staff. Cesarean section. Motion picture demonstration of colpocleisis operation.

COOK COUNTY HOSPITAL

CAREY CULBERTSON and A. E. KANTER. Operations.
D. S. HILLIS. Treatment of abortion; ward walk.

PRESBYTERIAN HOSPITAL

N. S. HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D. ALLEN and H. BOYSEN. Operations.

MICHAEL REESE HOSPITAL

J. L. BAER, J. E. LACKNER, WILLIAM RUBOVITS, I. F. STEIN and RALPH REIS. Operations.

ST. LUKE'S HOSPITAL

H. O. JONES and associates. Clinic.

WESLEY MEMORIAL HOSPITAL

MARK GOLDSTINE and associates. Uterine bleeding.

FRANCES E. WILLARD HOSPITAL

ASCHER H. GOLDFINE. Clinic.

WOMEN AND CHILDREN'S HOSPITAL

MARY EDITH WILLIAMS. Removal of abdominal and pelvic tumors.
OTILLIE ZELEZNY. Electrocoagulation of the cervix uteri.

Tuesday Afternoon

CHICAGO LYING-IN HOSPITAL

WILLIAM J. DIECKMANN and staff. Dry clinic: Eclampsia. Motion picture demonstration of forceps delivery.

COOK COUNTY HOSPITAL

J. P. GREENHILL. Operations.
L. RUDOLPH and J. H. BLOOMFIELD. Symposium: The toxemias of pregnancy.

ST. BERNARD'S HOSPITAL

S. S. SCHOCHET. Fibroids.

ST. ELIZABETH'S HOSPITAL

J. R. LAVIERI. Cesarean section.

ST. MARY OF NAZARETH HOSPITAL

L. KOZAKIEWICZ and M. UZNANSKI. Toxemias of pregnancy.

FRANCES E. WILLARD HOSPITAL

ASCHER H. GOLDFINE. Clinic.

WOMEN AND CHILDREN'S HOSPITAL

ELOISE PARSONS. Vaginal hysterectomy; vaginal sterilization; ligation of tubes per vaginal route.

Wednesday Morning

CHICAGO LYING-IN HOSPITAL

FRED L. ADAIR, WILLIAM J. DIECKMANN, M. EDWARD DAVIS, H. C. HESSELTINE and staff. Operations and demonstration of cases.

COOK COUNTY HOSPITAL

C. W. BARRETT. Operations.
J. E. FITZGERALD. Heart disease in pregnancy; ward walk.

EVANGELICAL DEACONESS HOSPITAL

A. J. SCHOENBERG. Hysterectomy.

JACKSON PARK HOSPITAL

CHARLES F. GREENE, LOUIS H. STERN, W. J. NIXON-DAVIS, JR. and NORMAN ZOLLA. Treatment of contracted pelves by cesarean section, version and forceps.

PASSAVANT MEMORIAL HOSPITAL

GEORGE GARDNER and ARTHUR H. CURTIS. Gynecological pathology—demonstration and conference.

PRESBYTERIAN HOSPITAL

N. S. HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D. ALLEN and H. BOYSEN. Demonstration of cases.

RESEARCH AND EDUCATIONAL HOSPITALS

FREDERICK H. FALLS. Eclamptogenic toxemia, low cervical cesarean section under local anesthesia.
W. H. BROWNE. Progestin in the treatment of abortion.
G. H. REZEK. Modification of the Friedmann reaction.

MICHAEL REESE HOSPITAL

Dry Clinic

JOSEPH L. BAER. Shifting trends in the treatment of prolapse of the uterus.
JULIUS E. LACKNER. Recent investigations in the action of progesterone.
WILLIAM H. RUBOVITS. Postoperative vaginal antisepsis.
IRVING F. STEIN. Evaluation of the "safe period."
RALPH A. REIS. Mammography.
LESTER E. FRANKENTHAL, JR. Treatment of vulvovaginitis.

MICHAEL L. LEVENTHAL. The Manchester operation for the cure of cystocele and prolapse.
HENRY BUXBAUM. The role of spermotoxin in temporary sterility.
A. F. LASH. Early diagnosis of carcinoma of the uterus.
E. J. DECOSTA. The use of progesterone in the prevention of habitual abortion.
ALFRED J. KOBAK. Maternal mortality in Chicago.
HERMAN STRAUSS. Routine palpation of the ureters during hysterectomy.

WESLEY MEMORIAL HOSPITAL

CHARLES B. REED, WILLIAM B. SERBIN and G. C. RICHARDSON. Moving picture demonstration of low forceps, breech extraction with forceps on aftercoming head, spontaneous breech—manual aid.

WOMEN AND CHILDREN'S HOSPITAL

FLORENCE HARK. Prenatal care with reference to the baby.
RUTH R. DARROW. Treatment of icterus gravis.
BERTHA VAN HOOSEN. Maternity mortality.

Wednesday Afternoon

CHICAGO LYING-IN HOSPITAL

H. C. HESSELTINE and staff. Nonconvulsive toxemia of pregnancy. Motion picture demonstration of birth injury.

CHICAGO MEMORIAL HOSPITAL

PAUL M. CLIVER, JULIA C. STRAWN, HARRY L. MEYERS, BEATRICE E. TUCKER and WALTER WIBORG. Plastic repair.
JAMES E. FITZGERALD, WILLIAM F. HEWITT, GEORGE N. SCHIFF and HARRY BENARON. Cesarean section.

COOK COUNTY HOSPITAL

W. T. CARLISLE. Operations.
D. S. HILLIS, J. H. BLOOMFIELD and A. F. LASH. Symposium: Cesarean section.

RESEARCH AND EDUCATIONAL HOSPITALS

FREDERICK H. FALLS and staff. Operations. Symposium: Gynecological tumors.
FREDERICK H. FALLS. Vulva carcinoma, demonstration of cases, vulvectomy under local anesthesia.
R. A. LIFVENDAHL. Solid tumors of ovary; removal of ovarian cyst.
H. H. HILL. Early carcinoma of cervix.

WOMEN AND CHILDREN'S HOSPITAL

CONSTANCE O'BRITIS. Operations.
BERTHA VAN HOOSEN and MAUDE HALL WINNETT. Anesthesia in obstetrics.
BEATRICE E. TUCKER. Parasacral anesthesia.

Thursday Morning

CHICAGO LYING-IN HOSPITAL

FRED L. ADAIR, WILLIAM J. DIECKMANN, M. EDWARD DAVIS, H. C. HESSELTINE and staff. Cesarean section. Motion picture demonstration of blood transfusion.

CHICAGO MEMORIAL HOSPITAL

PAUL M. CLIVER, JULIA C. STRAWN, HARRY L. MEYERS, BEATRICE E. TUCKER and WALTER WIBORG. Symposium: The treatment of prolapse of the uterus, cystocele and rectocele at various ages.
JAMES E. FITZGERALD, WILLIAM F. HEWITT, GEORGE N. SCHIFF and HARRY BENARON. Indications and technique for cesarean section; nerve block in obstetrics.

COOK COUNTY HOSPITAL

EGON W. FISCHMANN. Operations.
J. E. FITZGERALD and L. RUDOLPH. Symposium: Ectopic pregnancy, its diagnosis and treatment.

MOUNT SINAI HOSPITAL

A. H. KLAWANS. Endometriosis.
A. E. KANTER. Masculinizing tumors of ovary.
A. F. LASH. Pelvic infections.
A. H. E. GOLDFINE, C. NEWBERGER, H. BUXBAUM and associates. Symposium: Obstetrical hemorrhages.
L. RUDOLPH. Physiological and clinical aspect of occipito-posterior position.
A. ARKIN, I. A. RABENS and R. GORDON. Medicosurgical discussion.

PRESBYTERIAN HOSPITAL

N. S. HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D. ALLEN and H. BOYSEN. Operations.

ST. ANTHONY DE PADUA HOSPITAL

M. A. WEISSKOPF. Operations.

WASHINGTON BOULEVARD HOSPITAL

PAUL C. FOX. Operations and demonstration of cases.

WESLEY MEMORIAL HOSPITAL

MARK GOLDSTINE and associates. Vaginal plastics.

Thursday Afternoon

CHICAGO LYING-IN HOSPITAL

M. EDWARD DAVIS and staff. Placenta prævia; abruptio placenta. Motion picture demonstration of postpartum hemorrhage.

COOK COUNTY HOSPITAL

FREDERICK H. FALLS. Operations.
J. H. BLOOMFIELD and D. S. HILLIS. Symposium: Late hemorrhages of pregnancy.

ST. MARY OF NAZARETH HOSPITAL

H. LITTLE. Ovarian tumors.

Friday Morning

CHICAGO LYING-IN HOSPITAL

FRED L. ADAIR, WILLIAM J. DIECKMANN, M. EDWARD DAVIS, H. C. HESSELTINE and staff. Cesarean section. Dry clinic.

COOK COUNTY HOSPITAL

A. E. KANTER and CAREY CULBERTSON. Operations.
A. F. LASH. Toxemias of pregnancy; ward walk.

PRESBYTERIAN HOSPITAL

N. S. HEANEY, CAREY CULBERTSON, A. E. KANTER, E. D. ALLEN and H. BOYSEN. Operations.

MICHAEL REESE HOSPITAL

J. L. BAER, J. E. LACKNER, WILLIAM RUBOVITS, I. F. STEIN and RALPH REIS. Operations.

ST. BERNARD'S HOSPITAL

J. B. HAEBERLIN. Hysterectomy and its indications.

WESLEY MEMORIAL HOSPITAL

CHARLES B. REED, WILLIAM B. SERBIN and G. C. RICHARDSON. Ablatio placenta; placenta prævia.

WOMEN AND CHILDREN'S HOSPITAL

BERTHA VAN HOOSEN and MAUDE HALL WINNETT. Surgical cases complicating obstetrics.

Friday Afternoon

CHICAGO LYING-IN HOSPITAL

FRED L. ADAIR and staff. Dry clinic. Motion picture demonstration of episiotomy.

COOK COUNTY HOSPITAL

CAREY CULBERTSON. Operations.

L. RUDOLPH. Symposium: Prolonged labor; constriction ring dystocia.

MERCY HOSPITAL

H. E. SCHMITZ and associates. Symposium on operative gynecology.

RESEARCH AND EDUCATIONAL HOSPITALS

FREDERICK H. FALLS and staff. Symposium: Gynecological plastic operations with special reference to the use of local anesthesia.

FREDERICK H. FALLS. Vaginal hysterectomy for procidentia under local anesthesia.

M. J. SUMMERVILLE. Anterior colporrhaphy and interposition operation under local anesthesia.

WILLIAM H. BROWNE. Sturmdorf-Kelly incontinence operation and perineorrhaphy under local anesthesia.

WOMEN AND CHILDREN'S HOSPITAL

CATHERINE TRUE. Abdominal gynecological cases.

ELOISE PARSONS. Treatment of sterility; treatment of eroded cervix by cautery; lipiodol visualization of uterus and tubes.

Days to be Announced

COOK COUNTY HOSPITAL

J. P. GREENHILL, C. W. BARRETT, W. T. CARLISLE, EGON W. FISCHMANN, FREDERICK H. FALLS, A. E. KANTER and CAREY CULBERTSON. Symposium on fibroids.

HENROTIN HOSPITAL

EDWARD L. CORNELL. Operations and demonstration of cases.

CHANNING W. BARRETT and LEE STONE. Operations and demonstration of cases.

ORTHOPEDIC SURGERY

Monday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

H. B. THOMAS, F. W. HARK and C. N. LAMBERT. Symposium: Tenodesis. Operations and demonstration of cases; tendon transplantations.

Tuesday Morning

CHILDREN'S MEMORIAL HOSPITAL

F. CHANDLER, F. SEIDLER, C. PEASE and J. NORCROSS. Operations and demonstration of cases.

COLUMBUS HOSPITAL

E. H. SLOTT and I. E. SLOTT. Sciatica.

COOK COUNTY HOSPITAL

ARTHUR CONLEY. Operations and symposium with demonstration of cases; blind pegging of hip for fracture of neck of femur, using Kirschner wire and Smith-Petersen nail; problems in diagnosis of bone tumors; painful back in medicolegal cases; persistent dizziness following head injuries; fractures in and about the ankle.

MARCUS H. HOBART. Operation: Removal of internal semilunar cartilage. Demonstration of cases: Recurrent dislocations of the shoulder, internal derangement of the knee joint, spinal fusions and low back pain, acquired dislocations of the hip following scarlet fever, syndactylism.

PRESBYTERIAN HOSPITAL

E. J. BERKHEISER. Dry clinic and demonstration of cases.

MICHAEL REESE HOSPITAL

PHILIP LEWIN, DANIEL LEVINTHAL, CHARLES PEASE, F. GLASSMAN, SIDNEY SIDEMAN, JEROME G. FINDER and I. WOLIN. Operations.

Tuesday Afternoon

MOUNT SINAI HOSPITAL

C. JACOBS. Orthopedic demonstrations.

L. MILLER. Visualization of joints.

J. FINDER. Giant cell tumor of bone.

F. GLASSMAN. Nonunion of neck of femur.

WESLEY MEMORIAL HOSPITAL

F. M. JANSEY, H. KELIKIAN and O. H. HORRALL. Bone and joint surgery.

Wednesday Morning

LUTHERAN DEACONESS HOSPITAL

EMIL VRTIAK. Indications for surgical treatment of arthritis.

MUNICIPAL TUBERCULOSIS SANITARIUM

E. J. BERKHEISER. Bone tuberculosis.

ST. BERNARD'S HOSPITAL

L. B. DONKLE and M. E. CREIGHTON. Fractures of the shaft of the femur.

WESLEY MEMORIAL HOSPITAL

PHILIP H. KREUSCHER and associates. Bone and joint surgery; knee injuries.

Wednesday Afternoon

EVANSTON HOSPITAL

J. L. PORTER and R. C. LONERGAN. Low back disorders.

MERCY HOSPITAL

J. D. CLARIDGE and associates. Problems in orthopedic and traumatic surgery.

PASSAVANT MEMORIAL HOSPITAL

EMIL HAUSER and associates. Surgery of the knee and foot—demonstration of cases and lantern slides: Total tendon transplant for slipping patella; injuries of the external semilunar cartilage; loose body, the result of a semilunar cartilage injury; manipulative correction of deformity; tendon transplant as a routine procedure to triple arthrodesis of the paralytic foot; reconstruction operation for hallux valgus.

PRESBYTERIAN HOSPITAL

E. J. Berkheiser, Kellogg Speed and D. Rider. Operations.

MICHAEL REESE HOSPITAL

Philip Lewin. Fracture problems; new approach for arthrodesis of knee joint; discussion of bone tumors; motion picture demonstration of manipulative surgery.

Sidney Sideman. Rice bodies in tendon sheath of the hand; Hoke stabilization of the foot; spastic paralysis; roentgenologic library of the hip joint; fusion operation in tuberculosis of the knee joint; bunion operation; multiple cartilaginous exostosis.

Daniel H. Levinthal and Irving Wolin. Tendon transplantation in poliomyelitis, spastic paralysis, recurrent dislocation of shoulder, flat feet; demonstration of arthroplasties of the knee, hip and elbow, knee joint surgery.

Charles Pease. Acute transverse atrophy of bone; traumatic rupture of intervertebral disc; reduction of compression fracture of spine, osteochondromatosis of the elbows.

Jerome G. Finder. Chondromyxosarcoma, two cases; flexorplasty of the thumb for paralytic opponens pollicis; osteochondroma of the tibia; McBride bunion plasty; unusual bone tumor (?) of femur; Key operation for soft corns; spastic paralysis—bilateral adductor tenotomy and obturator nerve neurectomy, case with unusual deformities.

Frank Glassman. Fracture and dislocation of shoulder; supracondylar fracture of the humerus; fracture of the neck of the femur; complete fracture of the tibia and fibula; removal of the head of the radius, three cases; osteoma of the femur; demonstration of various types of fractures and treatment.

ST. ANTHONY DE PADUA HOSPITAL

Thomas Dwyer. New bone biopsy trephine, pathological specimens.

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL

Presentation on Bone and Joint Surgery

E. L. Compere. Leg lengthening operation, technique and results; spinal fusion in the correction of scoliosis.

C. H. Hatcher. The pathology and treatment of tuberculous arthritis; studies in the rate of skeletal growth and equalization of limb length.

H. N. Harkins. Bone graft operations for ununited fracture.

P. C. Bucy and R. B. Cloward. Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis.

C. B. Huggins. Studies in the distribution of red bone marrow and the reticuloendothelial system in the skeleton.

COOK COUNTY HOSPITAL

Daniel H. Levinthal. Bone graft surgery for nonunion, stabilization and benign bone tumors. Motion picture demonstration: Surgical treatment of spastic paralysis; surgical treatment of residual paralysis following poliomyelitis.

Philip H. Kreuscher. Nicola operation; semilunar cartilage derangement; spinal grafts; new operation for hip fusion; new operation for knee fusion.

Philip Lewin. Tunnel skin graft over os calcis; spondylolisthesis; stabilization of paralytic varus foot; arthrodesis of ankle joint; hallux varus; tuberculous spine, fusion; infantile paralysis; low back pain with "sciatica."

Frank G. Murphy. Skin grafts for old wounds of leg; unusual bone tumors; fracture into ankle joint; malunion of Colles' fracture; tuberculosis of cuneiform bone; scar contracture of forearm, skin graft.

ILLINOIS MASONIC HOSPITAL

Charles N. Pease and Edgar White. Tuberculosis of the knee; fractures about the elbow in children; reduction of fractures of the spine; traumatic rupture of the intervertebral disc.

MICHAEL REESE HOSPITAL

Philip Lewin, Daniel Levinthal, Charles Pease, F. Glassman, I. Wolin, Sidney Sideman and Jerome G. Finder. Operations.

ST. BERNARD'S HOSPITAL

S. L. Governale. Pseudomuscular dystrophy; case demonstration.

J. G. Frost. Metastatic hypernephroid carcinoma of the femur.

R. S. Westline and E. L. Arensdorf. Fractures of the wrist joint.

ST. MARY OF NAZARETH HOSPITAL

L. Czaja. Clinic.

VETERANS ADMINISTRATION FACILITY

S. K. Livingston. Operations.

Thursday Afternoon

COOK COUNTY HOSPITAL

E. J. Berkheiser. Operations and demonstration of cases—spondylolisthesis, anterior poliomyelitis, arthrodesis and tendon transplantation.

PRESBYTERIAN HOSPITAL

E. J. Berkheiser and D. Rider. Operations.

RESEARCH AND EDUCATIONAL HOSPITALS

H. B. Thomas, F. W. Hark and C. N. Lambert. Operation: Shelving of a congenital dislocated hip. Demonstration of patients with closed reduction, open reduction, and shelving of congenital dislocation.

ST. LUKE'S HOSPITAL

E. W. Ryerson and associates. Demonstration of cases.

VETERANS ADMINISTRATION FACILITY

S. K. Livingston. Symposium: Bone tumors.

Friday Morning

LUTHERAN DEACONESS HOSPITAL

Emil Vrtiak. Indications for surgical treatment of arthritis.

PRESBYTERIAN HOSPITAL

E. J. Berkheiser, Kellogg Speed and D. Rider. Operations.

ST. BERNARD'S HOSPITAL

Chester C. Guy. Surgical pathology of bone tumors.

VETERANS ADMINISTRATION FACILITY

S. K. Livingston. Symposium: Maggot treatment of osteomyelitis.

GENITO-URINARY SURGERY

Monday Afternoon

COLUMBUS HOSPITAL

WILLIAM GEHL, FRANK L. CHENOWETH, H. E. DAVIS and I. F. VOLINI. Resectoscope for bladder carcinoma.

Tuesday Morning

MOUNT SINAI HOSPITAL

H. ROLNICK, H. SOLOWAY and E. HIRSCH. Symposium: Tumors of the kidney.

PASSAVANT MEMORIAL HOSPITAL

L. L. VESEEN, V. L. LESPINASSE, HARRY CULVER and FRED LIEBERTHAL. Symposium: Tuberculosis of the urinary tract.

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, ROBERT HERBST and associates. Operations.

MICHAEL REESE HOSPITAL

I. KOLL, J. EISENSTAEDT, H. ROLNICK, I. SHAPIRO, J. GROVE, F. LIEBERTHAL and A. E. JONES. Symposium: Carcinoma of the urinary bladder.

ST. JOSEPH'S HOSPITAL

CHARLES M. MCKENNA. Undescended testicle.

ST. MARY OF NAZARETH HOSPITAL

J. WELFELD. Urologic clinic: Malignancy of tumors of the bladder in children.

WESLEY MEMORIAL HOSPITAL

V. D. LESPINASSE and associates. Clinic.

WOMEN AND CHILDREN'S HOSPITAL

MARIE ORTMAYER and PEARL M. STETLER. Clinic.

Tuesday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

C. M. MCKENNA, R. D. HERROLD and staff. Operations and demonstrations: Experimental and clinical studies on various types of urinary antiseptics; anomalies with special reference to undescended testicle and hypospadias.

ST. ANTHONY DE PADUA HOSPITAL

O. J. JIRSA. Prostatic management; carcinoma of bladder; pyelography.

Wednesday Morning

CHICAGO MEMORIAL HOSPITAL

J. WILLIAM PARKER and JOHN P. O'NEIL. Operations.

COOK COUNTY HOSPITAL

HARRY CULVER, L. L. VESEEN, CHARLES MCKENNA and HARRY ROLNICK. Operations.

GARFIELD PARK HOSPITAL

VINCENT J. O'CONOR, C. C. SAELHOF and associates. More recent advances in infections in the urinary tract.

MERCY HOSPITAL

H. E. LANDES. Symposium: Transurethral resection.

J. E. LAIBE and associates. Kidney anomalies; treatment of neoplasms of the urinary tract.

MUNICIPAL TUBERCULOSIS SANITARIUM

DORRIN RUDNICK. Tuberculosis of the genito-urinary tract.

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, ROBERT HERBST and associates. Operations.

MICHAEL REESE HOSPITAL

I. KOLL, J. EISENSTAEDT, H. ROLNICK, I. SHAPIRO, J. GROVE, F. LIEBERTHAL and A. E. JONES. Operations.

WASHINGTON BOULEVARD HOSPITAL

VINCENT J. O'CONOR. Dry clinic.

Wednesday Afternoon

CHICAGO MEMORIAL HOSPITAL

J. WILLIAM PARKER, JOHN P. O'NEIL, E. J. STIEGLITZ, D. G. BRUNJES, OTTO SAPHIR and GEORGE M. LANDAU. Symposium: Kidney infections.

M. L. WEINSTEIN, J. WILLIAM PARKER and JOHN P. O'NEIL. Transurethral resection of the prostate.

R. A. MELENDY, J. WILLIAM PARKER, JOHN P. O'NEIL and OTTO SAPHIR. Tuberculosis of the genito-urinary tract in males.

EVANSTON HOSPITAL

J. I. FARRELL. Undescended testicles.

ST. ANNE'S HOSPITAL

HARRY J. DOOLEY. Urological clinic and demonstration of cases.

ST. BERNARD'S HOSPITAL

ANDREW SULLIVAN. Operations.

ST. ELIZABETH'S HOSPITAL

T. G. MCDOUGALL. Carcinoma of the bladder.

Thursday Morning

CHILDREN'S MEMORIAL HOSPITAL

HERMAN L. KRETSCHMER and K. BARBER. Operations and demonstration of cases.

COOK COUNTY HOSPITAL

HARRY CULVER and CHARLES MCKENNA. Symposium: Chronic bladder neck obstructions in the male.

ILLINOIS MASONIC HOSPITAL

EDWARD W. WHITE, ROBERT H. HAYES and JOHN H. GILMORE. Renal tuberculosis: Avenues of transmission, discussion of the pathogenesis and morbidity, primary foci and complicating factors in relation to general tuberculosis, roentgenological aspects; concerning prostatic resection.

CLARENCE C. SAELHOF and JOHN H. GILMORE. Carcinoma of bladder—diagnosis, type of treatment and approach, result and cases; renal calculi—multiple stone in reduplicated pelvis, diagnosis, treatment by heminephrectomy; operative cases; malignancy of prostate gland—diagnosis, method of immediate relief for obstructive symptoms, postoperative radiation therapy and results, cases; roentgenological advances in urologic diagnosis.

JACKSON PARK HOSPITAL

WILLIAM YONKER. Transurethral prostatic resection compared to other types of prostatic surgery.

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, ROBERT HERBST and associates. Operations.

MICHAEL REESE HOSPITAL

I. KOLL, J. EISENSTAEDT, H. ROLNICK, I. SHAPIRO, J. GROVE, F. LIEBERTHAL and A. E. JONES. Operations.

ST. JOSEPH'S HOSPITAL

CHARLES M. MCKENNA. Undescended testicle.

ST. LUKE'S HOSPITAL

L. W. SCHMIDT and associates. Dry clinic.

VETERANS ADMINISTRATION FACILITY

T. G. MCDOUGALL. Carcinoma of the bladder.

WESLEY MEMORIAL HOSPITAL

V. D. LESPINASSE and associates. Clinic.

Friday Morning

EVANGELICAL DEACONESS HOSPITAL

PAUL MORF. Nephrolithotomy.

ILLINOIS MASONIC HOSPITAL

C. OTIS RITCH. Nephrectomy; transurethral prostatic resection; urological clinic: Anomalies of upper urinary tract, bilateral and unilateral complete reduplication of kidneys and ureters, incomplete reduplication of kidneys and ureters, bifid pelves, ureteral buds; renal tuberculosis.

PRESBYTERIAN HOSPITAL

HERMAN L. KRETSCHMER, ROBERT HERBST and associates. Dry clinic.

VETERANS ADMINISTRATION FACILITY

T. G. MCDOUGALL. Perineal prostatectomy.

Days to be Announced

COOK COUNTY HOSPITAL

L. L. VESEEN and HARRY ROLNICK. Symposium: Pyogenic infections of the upper urinary tract.

HENROTIN HOSPITAL

DORRIN RUDNICK. Kidney complications in women.

FRACTURES AND TRAUMATIC SURGERY

Monday Afternoon

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates. Operative fractures.

JACKSON PARK HOSPITAL

S. W. M. ROBINSON, C. W. HENNAN and M. J. MILLS. Traumatic surgery.

ST. ANTHONY DE PADUA HOSPITAL

F. W. SLOBE. Fractures; special phases of traumatic surgery.

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL

ARTHUR H. CONLEY and S. PERRY ROGERS. Symposium: Blind pegging of fractures of the femur.

FRED MILLER, T. C. BROWNING, EMILE DUVAL and GEORGE M. LANDAU. Fracture of both bones of lower leg.

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates. Ward walk.

ST. JOSEPH'S HOSPITAL

HUGH MCKENNA. Demonstration clinic.

WASHINGTON BOULEVARD HOSPITAL

ARTHUR R. METZ. General surgery and fractures.

Tuesday Afternoon

CHICAGO MEMORIAL HOSPITAL

C. R. G. FORRESTER, HORACE STIMSON and A. H. MASON. Symposium: Fractures; nerve repair.

COOK COUNTY HOSPITAL

SUMNER L. KOCH and associate. Tendon and nerve suturing of the hand; hand infections.

VETERANS ADMINISTRATION FACILITY

S. K. LIVINGSTON. Dry clinic.

Wednesday Morning

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates. Ward walk.

FREDERICK DYAS. Ward walk (female).

EVANSTON HOSPITAL

DWIGHT CLARK. Fractures about the knee joint.

ST. ANNE'S HOSPITAL

THOMAS E. MEANY. Fractures and tendon transplantations.

ST. BERNARD'S HOSPITAL

L. B. DONKLE and M. E. CREIGHTON. Fractures of the shaft of the femur.

Wednesday Afternoon

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS, JAMES J. CALLAHAN, CARLO S. SCUDERI, FREDERICK DYAS and GEORGE L. APFELBACH. Symposium: Knee joint injuries.

PASSAVANT MEMORIAL HOSPITAL

PAUL B. MAGNUSON and JAMES K. STACK. Symposium on fractures.

Thursday Morning

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates. Ward walk.

GARFIELD PARK HOSPITAL

J. J. CALLAHAN, H. N. WAIT and MILTON SCHMITT. Demonstration clinic.

JACKSON PARK HOSPITAL

ARRIE BAMBERGER. Demonstration clinic.

ST. BERNARD'S HOSPITAL

R. S. WESTLINE and E. L. ARENSDORF. Fractures of the wrist joint.

ST. JOSEPH'S HOSPITAL

HUGH MCKENNA. Demonstration clinic.

ST. MARY OF NAZARETH HOSPITAL

L. CZAJA. Symposium: Late results of fractures.

U. S. MARINE HOSPITAL

HORACE P. STIMSON. Ununited fractures with osteomyelitis.

E. C. LUTTON and R. W. FLYNN. Skeletal traction and countertraction in treatment of fractures.

FRANCES E. WILLARD HOSPITAL

JAMES A. VALENTINE. Clinic.

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL

ARTHUR H. CONLEY and S. PERRY ROGERS. Blind pegging of fractures of the femur.

FRED MILLER, T. C. BROWNING, EMILE DUVAL and GEORGE M. LANDAU. Fracture of both bones of the lower leg.

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates. Operative fractures.

GEORGE L. APFELBACH. Ward walk (female).

JACKSON PARK HOSPITAL

S. W. M. ROBINSON, C. W. HENNAN and M. J. MILLS. Traumatic surgery.

FRANCES E. WILLARD HOSPITAL

FRED CARLS. Clinic.

WOMEN AND CHILDREN'S HOSPITAL

ARMINA HILL. Minor injuries.

MARY E. WILLIAMS. Fractures; dislocations.

Friday Morning

CHICAGO MEMORIAL HOSPITAL

C. R. G. FORRESTER, HORACE STIMSON and A. H. MASON Fractures; nerve repair.

COOK COUNTY HOSPITAL

WILLIAM R. CUBBINS and associates. Follow-up clinic; demonstration of cases.

Friday Afternoon

COLUMBUS HOSPITAL

F. MUELLER. Fractures.

W. L. BEECHER. Traumatic surgery.

COOK COUNTY HOSPITAL

JAMES J. CALLAHAN and CARLO S. SCUDERI. Cadaver demonstrations.

Days to be Announced

COOK COUNTY HOSPITAL

DR. GATEWOOD. Symposium: Fractures in children.

HENROTIN HOSPITAL

ARTHUR R. CONLEY. Demonstration clinic.

PLASTIC AND FACIOMAXILLARY SURGERY

Monday Afternoon

ILLINOIS EYE AND EAR INFIRMARY

SAMUEL SALINGER. Plastic surgery of the nose.

SIDNEY POLLACK. Nasal fractures.

BERNARD M. COHEN. Nasal and ear prostheses.

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL

CASPER M. EPSTEIN. Symposium: Plastic, including faciomaxillary surgery.

COOK COUNTY HOSPITAL

JOSEPH E. SCHAEFER. Demonstration of cases showing corrected temporomandibular ankylosis, harelips and cleft palates; pedicle flap and full thickness graft cases; repair of burns, traumatic injuries; plastic repairs of controlled carcinoma cases.

ST. JOSEPH'S HOSPITAL

WILLIAM H. G. LOGAN. Oral surgery.

Tuesday Afternoon

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED. Operations.

MICHAEL REESE HOSPITAL

SAMUEL SALINGER and CASPER EPSTEIN. Nasal and facial plastic surgery; treatment of injuries to the face.

Wednesday Afternoon

MOUNT SINAI HOSPITAL

E. AISON and associates. Oral surgery.

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED. Operations.

Thursday Morning

COOK COUNTY HOSPITAL

JOSEPH E. SCHAEFER. Demonstration of cases showing carcinoma of mouth, lips and face, with colored photographs of lesions before and after radiation.

MICHAEL REESE HOSPITAL

CASPER EPSTEIN. Oral surgery.

ST. JOSEPH'S HOSPITAL

WILLIAM H. G. LOGAN. Oral surgery.

Thursday Afternoon

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED. Dry clinic.

Friday Afternoon

CHILDREN'S MEMORIAL HOSPITAL

L. W. SCHULTZ. Dry clinic and demonstration.

PRESBYTERIAN HOSPITAL

FREDERICK MOOREHEAD and R. OLMSTED. Operations.

RESEARCH AND EDUCATIONAL HOSPITALS

L. W. SCHULTZ. Oral surgery with particular reference to cleft palates and harelips.

Day to be Announced

COOK COUNTY HOSPITAL

I. MUSKAT. Plastic surgery of the nose and face.

NEUROSURGERY

Monday Afternoon

COOK COUNTY HOSPITAL

H. C. VORIS and J. J. KEARNS. Intracranial injury—demonstration of pathology, physiology, management, surgical interference, sequelæ, complications.

Tuesday Morning

RESEARCH AND EDUCATIONAL HOSPITALS

GEZA DETAKATS. Operation: Lumbar sympathectomy.

Symposium: Neurocirculatory Diseases

R. BRUNNER. The use of neosynephrine in spinal anesthesia.

WILLIAM C. BECK. Selection of cases for sympathectomy; demonstration of sympathectomized patients; evaluation of results; the management of lymphedema.

F. K. HICK. Vascular accidents associated with coronary occlusion.

H. C. LUETH. Unusual reactions following the use of nitroglycerine.

GEZA DETAKATS. The treatment of acute arterial occlusion; operability of hypertension, demonstration of cases.

H. L. MISHKIN and P. J. SARMA. The treatment of varicose veins and ulcers.

J. T. REYNOLDS. Amputations in peripheral vascular disease.

Tuesday Afternoon

MERCY HOSPITAL

C. F. SCHAUB and H. C. VORIS. Neuro-ophthalmology: Presentation of cases with fundi, perimetric field findings; discussion of diagnostic problems; presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.

PRESBYTERIAN HOSPITAL

A. VERBRUGGHEN. Dry clinic and demonstration.

Wednesday Morning

RESEARCH AND EDUCATIONAL HOSPITALS

ERIC OLDBERG. Operations and demonstration of cases.

Wednesday Afternoon

COOK COUNTY HOSPITAL

A. VERBRUGGHEN. Surgical paraplegia—etiology, pathology, classification, physiology, treatment, prognosis.

PRESBYTERIAN HOSPITAL

A. VERBRUGGHEN. Operations.

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL

P. C. BUCY and R. B. CLOWARD. Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis.

RESEARCH AND EDUCATIONAL HOSPITALS

ERIC OLDBERG. Operations and demonstration of cases.

Thursday Afternoon

MERCY HOSPITAL

H. C. VORIS and associates. Symposium: Management of cerebral gliomas.

H. C. VORIS and H. E. LANDES. Demonstration of choroid plexus resection in hydrocephalus; cytometric studies in neurological lesions.

C. F. SCHAUB and H. C. VORIS. Neuro-ophthalmology: Presentation of cases with fundi, perimetric field findings; discussion of diagnostic problems; presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.

PRESBYTERIAN HOSPITAL

A. VERBRUGGHEN. Operations.

MICHAEL REESE HOSPITAL

Symposium: Intracranial Suppuration.

ROY GRINKER. Neurological aspects of intracranial suppuration.

A. VERBRUGGHEN. Surgical aspects of brain abscess.

Friday Afternoon

PASSAVANT MEMORIAL HOSPITAL

LOYAL DAVIS and JOHN MARTIN. Neurological surgery: Presentation emphasizing diagnosis and treatment.

PRESBYTERIAN HOSPITAL

A. VERBRUGGHEN. Operations.

THORACIC SURGERY

Monday Afternoon

ST. LUKE'S HOSPITAL

WILLARD VAN HAZEL. Demonstration clinic.

PAUL H. HOLINGER. Surgery of bronchii.

Tuesday Morning

COLUMBUS HOSPITAL

R. M. DAVISON, C. VOLINI, M. JOANNIDES, D. ORTH and G. MUELLER. Symposium in tuberculosis: Thoracic surgery; pneumothorax treatment including climatotherapy.

COOK COUNTY HOSPITAL

JOHN B. O'DONOGHUE and ROBERT LEE. Treatment of empyema; ward walk and presentation of cases.

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL. Operations with demonstration of cases.

ST. JOSEPH'S HOSPITAL

WILLIAM C. BECK. Thoracic surgery.

VETERANS ADMINISTRATION FACILITY

JEROME R. HEAD. New type of thoracoplasty; chest surgery.

Tuesday Afternoon

COOK COUNTY HOSPITAL

RALPH B. BETTMAN. Operations.

PRESBYTERIAN HOSPITAL

JOHN DORSEY. Dry clinic and demonstration.

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL and staff. Symposium: Bronchogenic carcinoma.
S. LEVINSON. Pathology.
ADOLPH HARTUNG. Roentgenological diagnosis.
PAUL H. HOLINGER. Bronchogenic aspects.
WILLARD VAN HAZEL. Surgical consideration; demonstration of cases and specimens; surgical treatment of mediastinal tumors.
T. J. WACHOWSKI. Roentgenological consideration of mediastinal tumors.
M. JOANNIDES. Collapse therapy of pulmonary tuberculosis.

Wednesday Morning

EVANSTON HOSPITAL

JEROME R. HEAD. Indications for lobectomy.

MUNICIPAL TUBERCULOSIS SANITARIUM

RICHARD DAVISON. Thoracoplasty.

ST. BERNARD'S HOSPITAL

R. J. DREVER. The rational treatment of empyema; demonstration of cases.
S. L. GOVERNALE and F. F. FIORE. Congenital cyst of the lung; demonstration of cases.

Wednesday Afternoon

MUNICIPAL TUBERCULOSIS SANITARIUM

M. JOANNIDES. Phrenic surgery; intrapleural pneumolysis.

PRESBYTERIAN HOSPITAL

JOHN DORSEY. Operations.

Thursday Morning

ILLINOIS MASONIC HOSPITAL

MINAS JOANNIDES. Phrenic neurectomy, phrenic crush, scaleniotomy; artificial pneumoperitoneum; eleothorax. Dry clinic: Eleothorax-Indications, technique and complications; advantages of artificial pneumoperitoneum as an adjunct to phrenic neurectomy.

MUNICIPAL TUBERCULOSIS SANITARIUM

RICHARD DAVISON. Thoracoplasty; pneumolysis.

ST. JOSEPH'S HOSPITAL

WILLIAM C. BECK. Thoracic surgery.

Thursday Afternoon

COOK COUNTY HOSPITAL

RALPH B. BETTMAN. Operations.

PRESBYTERIAN HOSPITAL

JOHN DORSEY. Operations.

MICHAEL REESE HOSPITAL

RALPH B. BETTMAN and WILLIAM TANNENBAUM. Thoracic surgery.

ST. BERNARD'S HOSPITAL

A. H. MONTGOMERY and R. E. CUMMINGS. Pericarditis with effusion; demonstration of case.

Friday Morning

MICHAEL REESE HOSPITAL

RALPH B. BETTMAN and WILLIAM TANNENBAUM. Thoracoplasty operation.
MAX BIESENTHAL. Surgery of pulmonary tuberculosis.
MAX BIESENTHAL and RALPH B. BETTMAN. Technique of various operations used for pulmonary tuberculosis: Artificial pneumothorax, pneumolysis, thoracoplasty; motion picture and diagrammatic demonstrations.
RALPH B. BETTMAN. Treatment of empyema; injuries of the chest; presentation of cases; motion picture and diagrammatic demonstrations.

WOMEN AND CHILDREN'S HOSPITAL

HELEN HAYDEN, EMELIA GIRYOTAS, MARGARET AUSTIN and NORA B. BRANDENBURG. Bronchoscopy in relation to asthma and allied pulmonary conditions; lipiodol injection.

Friday Afternoon

COOK COUNTY HOSPITAL

JOHN B. O'DONOGHUE, FREDERICK TICE, RICHARD JAFFE, M. J. HUBENY, S. H. ROSENBLUM and A. J. HRUBY. Symposium: Pulmonary tuberculosis.
JOHN B. O'DONOGHUE. Operations.

PRESBYTERIAN HOSPITAL

JOHN DORSEY. Operations.

TUMORS AND IRRADIATION

Monday Afternoon

ST. ELIZABETH'S HOSPITAL

J. BRAMS. Radium treatment of fractures.

VETERANS ADMINISTRATION FACILITY

G. R. ALLABEN. Regular tumor clinic.

Tuesday Morning

LUTHERAN DEACONESS HOSPITAL

ISADORE PILOT. Pathology of malignant growths in relation to therapeutic indications.

MICHAEL REESE HOSPITAL

MAX CUTLER, JEROME F. STRAUSS and SAMUEL PEARLMAN. Radium therapy in malignant tumors of the head and neck; demonstration of cases and technique.

ST. ELIZABETH'S HOSPITAL

M. G. LUKEN. Sarcoma of the stomach.

VETERANS ADMINISTRATION FACILITY

A. E. WILLIAMS. Deep x-ray and radium therapy.

Tuesday Afternoon

RAVENSWOOD HOSPITAL

C. BUSWELL, J. J. MOORE, H. P. SAUNDERS and L. E. SCHAEFFER. Cancer clinic, presentation of specimens, lantern slides, cases illustrating melanomas of shoulder and jaw.

RESEARCH AND EDUCATIONAL HOSPITALS

WILLARD VAN HAZEL and staff. Symposium: Bronchogenic carcinoma.
S. LEVINSON. Pathology.
ADOLPH HARTUNG. Roentgenological diagnosis.
PAUL H. HOLINGER. Bronchogenic aspects.
WILLARD VAN HAZEL. Surgical consideration; demonstration of cases and specimens; surgical treatment of mediastinal tumors.

M. JOANNIDES. Collapse therapy of pulmonary tuberculosis.
T. J. WACHOWSKI. Roentgenological consideration of mediastinal tumors.

Wednesday Morning

ALBERT MERRITT BILLINGS HOSPITAL

Presentation on Tumor Surgery

A. BRUNSCHWIG. Experimental production of tumors and the efficacy of Coley's toxin in the treatment of experimental sarcoma; palliative treatment of pulmonary metastases from malignant tumors; late results in treatment of benign giant cell tumors of bone.
D. B. PHEMISTER and associates. Studies in the etiology, diagnosis and treatment of bone tumors.
HARWELL WILSON. Extraskeletal ossifying tumors.

VETERANS ADMINISTRATION FACILITY

MAX CUTLER. Annual tumor clinic: Presentation of cancer cases, indications, technique and results of radium therapy.
G. R. ALLABEN. Diagnosis and treatment.

Thursday Morning

COLUMBUS HOSPITAL

D. A. ORTH, M. HANNAN and H. E. DAVIS. Symposium: Breast cancer.

LUTHERAN DEACONESS HOSPITAL

ISADORE PILOT. Pathology of malignant growths in relation to therapeutic indications.

MERCY HOSPITAL

W. J. PICKETT. Unusual cases of malignancy.

MICHAEL REESE HOSPITAL

MAX CUTLER and staff. Results of radiation treatment of cancer of mouth, tonsil, pharynx and larynx; presentation of cases. Radiation treatment of cancer of the breast; presentation of cases. Motion pictures illustrating the technique of radium treatment of cancer of the mouth and cancer of the cervix. Transillumination of the breast.

ST. ELIZABETH'S HOSPITAL

LEO M. ZIMMERMAN. Mediastinal tumors.

VETERANS ADMINISTRATION FACILITY

A. E. WILLIAMS. Inspection of deep x-ray and radium therapy unit.

WESLEY MEMORIAL HOSPITAL

GUY S. VAN ALSTYNE. Carcinoma of the breast; combined surgical and x-ray treatment.

Thursday Afternoon

PASSAVANT MEMORIAL HOSPITAL

MAX CUTLER. The organization of a tumor clinic: Personnel, equipment, records, follow-up.

Carcinoma of the Breast

JOHN A. WOLFER. Surgical considerations.
JAMES T. CASE. Pre- and postoperative x-ray radiation.
L. M. ROSENTHAL. Radium treatment.
MAJOR GREENE. Bronchiogenic tumors of the neck.
JOHN F. DELPH and EARL BARTH. Carcinoma of the larynx, hypopharynx and tonsil.
JOHN MOHARDT. A survey of some proposed cancer cures.

Friday Morning

MERCY HOSPITAL

HENRY L. SCHMITZ and associates. Symposium: Radiologic therapy of malignancy.

RESEARCH AND EDUCATIONAL HOSPITALS

R. B. MALCOLM. Operations: Neck dissection; carcinoma of breast; surgical pathology of breast tumors.
T. J. WACHOWSKI. X-ray treatment of carcinoma of breast.
ARRIE BAMBERGER. Ewing tumor with case report.

ST. BERNARD'S HOSPITAL

CHESTER C. GUY. Surgical pathology of bone tumors.

ST. LUKE'S HOSPITAL

H. E. MOCK and associates. Tumor clinic.

VETERANS ADMINISTRATION FACILITY

G. R. ALLABEN. Regular tumor clinic.

WESLEY MEMORIAL HOSPITAL

EARL LATIMER. Unusual breast tumors.

Friday Afternoon

PRESBYTERIAN HOSPITAL

CARL APPELBACH and F. SQUIRE. Dry clinic.

Day to be Announced

HENROTIN HOSPITAL

SAMUEL LEVINSON. Surgical pathology.

ROENTGENOLOGY

Tuesday Morning

LUTHERAN DEACONESS HOSPITAL

RALPH WILLY. Newer concepts in the treatment of carcinoma.

ST. MARY OF NAZARETH HOSPITAL

C. J. CHALLENGER. X-ray studies of surgical conditions.

Tuesday Afternoon

ST. ANTHONY DE PADUA HOSPITAL

L. S. TICHY. Silicosis demonstration.

ST. BERNARD'S HOSPITAL

B. C. CUSHWAY, R. J. MAIER and E. K. LEWIS. Roentgen therapy of inflammation and infections of the face and neck.

ST. LUKE'S HOSPITAL

STAFF. X-ray diagnosis.

Wednesday Afternoon

AUGUSTANA HOSPITAL

DAVID S. BEILEN. Roentgen diagnosis of gastro-intestinal lesions.

ALBERT MERRITT BILLINGS HOSPITAL

PAUL C. HODGES and associates. X-ray diagnosis.

Thursday Morning

LUTHERAN DEACONESS HOSPITAL

RALPH WILLY. Newer concepts in the treatment of carcinoma.

RESEARCH AND EDUCATIONAL HOSPITALS

ADOLPH HARTUNG. Conference on x-ray diagnosis, with particular reference to bone dystrophy, lesions of the urinary tract, brain tumors and unusual lesions of the gastro-intestinal tract.

Thursday Afternoon

COOK COUNTY HOSPITAL

ROBERT F. MCNATTIN. High voltage therapy of malignancies.

M. J. HUBENY. Roentgenological examination of appendix.

MOUNT SINAI HOSPITAL

MAX COHN, G. DANELIUS and E. LEWIN. Demonstrations of interesting radiologicosurgical conditions.

ST. LUKE'S HOSPITAL

STAFF. X-ray diagnosis.

Friday Afternoon

AUGUSTANA HOSPITAL

DAVID S. BEILEN. Roentgen diagnosis of lesions of urinary tract.

COOK COUNTY HOSPITAL

J. PAUL BENNETT. Roentgenological examination of the kidneys, ureters and bladder.

ROBERT F. MCNATTIN. High voltage therapy of malignancies.

Days to be Announced

HENROTIN HOSPITAL

ARTHUR R. HANSEN. X-ray demonstration.

WESLEY MEMORIAL HOSPITAL

FRANK L. HUSSEY. The interpretation of x-ray findings in obscure gastric and duodenal lesions; the use of x-ray in conjunction with surgery of the large bowel.

PHYSICAL THERAPY

Monday Afternoon

COOK COUNTY HOSPITAL

DISRAELI KOBAK. Discussion of general physical therapy procedures.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

JOHN S. COULTER and S. L. OSBORNE. Clinical and experimental investigations of short wave medical diathermy.

MICHAEL REESE HOSPITAL

C. O. MOLANDER. Ward walks; physiotherapy methods.

Tuesday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK. Physical therapy in posttraumatic conditions.

MUNICIPAL TUBERCULOSIS SANITARIUM

JOHN S. COULTER and LEO HARDT. Ultraviolet radiation in the treatment of gastro-intestinal tuberculosis.

Tuesday Afternoon

COOK COUNTY HOSPITAL

I. F. HUMMON. Physical therapy in infantile paralysis.

MICHAEL REESE HOSPITAL

S. PERLOW and C. O. MOLANDER. Physical therapy in the treatment of circulatory disturbances.

ST. LUKE'S HOSPITAL

GEZA DETAKATS and JOHN S. COULTER. Physical agents in the treatment of peripheral circulatory diseases: Constant temperature cradle, suction pressure apparatus, intermittent venous hyperemia, oscillating bed, mecholyl iontophoresis.

Wednesday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK. Physical therapy in postoperative and traumatic infections.

GARFIELD PARK HOSPITAL

MILTON SCHMITT. Hyperpyrexia in gonorrheal arthritis.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

HERMAN CHOR. Rationale of physical therapy in muscle disorders.

JOHN S. COULTER. Demonstration of clinical and experimental results.

MICHAEL REESE HOSPITAL

FRANK GLASSMAN and C. O. MOLANDER. Physical therapy in the treatment of fractures.

Wednesday Afternoon

COOK COUNTY HOSPITAL

I. F. HUMMON. Physical therapy in neurosurgical and neurological conditions.

GARFIELD PARK COMMUNITY HOSPITAL

MILTON G. SCHMITT. The value of heating tissues by induction, hyperpyrexia.

PASSAVANT MEMORIAL HOSPITAL

J. S. COULTER. Physical therapy in fractures.

SUMNER L. KOCH, MICHAEL L. MASON and J. S. COULTER. Physical therapy in hand injuries.

MICHAEL REESE HOSPITAL

I. WOLIN and C. O. MOLANDER. Physical therapy in the treatment of poliomyelitis.

SIDNEY SIDEMAN and C. O. MOLANDER. Physical therapy in treatment of spastics.

Thursday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK. Physical therapy in low back conditions.

ILLINOIS CENTRAL HOSPITAL

JOHN S. COULTER. Under water exercises in the treatment of fractures of weight-bearing bones.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

J. S. COULTER and S. L. OSBORNE. Hyperpyrexia in chronic infectious arthritis.

F. CHANDLER, J. R. NORCROSS and J. S. COULTER. Management of low back conditions.

MICHAEL REESE HOSPITAL

BERT FINNE. Hyperpyrexia in the treatment of gonorrheal arthritis.

Thursday Afternoon

COOK COUNTY HOSPITAL

I. F. HUMMON. Manipulative treatment in low back conditions.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

EMIL HAUSER and J. S. COULTER. The role of physical therapy in common disorders of the foot.

MICHAEL REESE HOSPITAL

JULIUS GRINKER and C. O. MOLANDER. Physical therapy in treatment of peripheral nerve injuries.

Friday Morning

COOK COUNTY HOSPITAL

DISRAELI KOBAK. Physical therapy in bursitis.

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

J. S. COULTER. Physical therapy in traumatic arthritis.

MICHAEL REESE HOSPITAL

LESTER FRANKENTHAL and C. O. MOLANDER. Physical therapy in treatment of chronic pelvic inflammation.

Friday Afternoon

COOK COUNTY HOSPITAL

I. F. HUMMON. Physical therapy in the prevention of deformities.

ST. LUKE'S HOSPITAL

H. E. MOCK and JOHN S. COULTER. Reconstructive cases in physical therapy.

EXPERIMENTAL SURGERY

Friday Morning

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

LEON ARIES. Acceleration of bone growth and repair as determined by deposition of dye in the callus. (By feeding dogs dyes which are deposited in the callus, experimental fractures are studied to determine what substances accelerate bone growth and repair.) Lantern slide demonstration.

R. A. BUSSABARGER, S. FREEMAN and A. C. IVY. The role of the stomach in calcification of bone. (Demonstration of gastrectomized puppies showing homogenous osteoporosis. This demonstration shows the necessity of observance of dietary care in gastrectomized patients.) Lantern slide demonstration.

ELMER J. KOCUR. The effect of various foods upon bile secretion with and without return of bile to the gastro-intestinal tract. (Demonstration of animals. This shows the necessity of adequate dietary control of patients with biliary fistulas.)

C. R. SCHMIDT and J. M. BEAZELL. The effect of diet on pancreatic secretion. (The results obtained guide the postoperative care of a patient with duodenal fistula.)

WILLIAM BACHRACH and SAMUEL J. FOGELSON. Common duct transplantation. (Demonstration of animal. Results obtained show the site of implantation of the common duct is important in preventing subsequent ascending infections of the biliary passages.)

MICHAEL L. MASON and HARVEY S. ALLEN. Experimental studies on tendon repair. (Histologic studies of tendon repair after use of varied suture material, grafts and different techniques.)

LEO M. ZIMMERMAN. Surgical repair of inguinal hernia as guided by anatomical studies. (A simplification of surgical technique for the treatment of inguinal hernia after evaluating the anatomy.)

JOHN MARTIN. The negative effects of midbrain lesions upon the gastric secretion, motility and gastro-intestinal ulceration in monkeys and cats. A Horsley-Clarke apparatus was used to produce midbrain lesions in cats and monkeys. No changes were observed in gastro-intestinal function and activity.

H. CHOR. The rational of physical therapy in the treatment of muscle disorders. Experimental observations on massage, passive movement, of electrical stimulation and of rest upon muscle atrophy and regeneration in the lower motor neuron type of paralysis.

MICHAEL REESE HOSPITAL

STAFF. Demonstration in experimental surgery.

Days to be Announced

ALBERT MERRITT BILLINGS HOSPITAL

LABORATORY STAFF. Demonstration in experimental surgery.

RESEARCH AND EDUCATIONAL HOSPITALS

WARREN H. COLE and associates. Period of experimental surgery.

OPHTHALMOLOGY

Monday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

A. C. KRAUSE. Fundus diagnosis.

CHILDREN'S MEMORIAL HOSPITAL

G. GUIBOR. Orthoptics.

COOK COUNTY HOSPITAL

E. B. FOWLER. Fundus diagnostic clinic.

ILLINOIS EYE AND EAR INFIRMARY

R. VON DER HEYDT. Operation for glaucoma and cataract.
DWIGHT C. ORCUTT. Dry clinic.

MERCY HOSPITAL

C. F. SCHAUB, F. I. BARNETT and E. A. ROLING. Fundus clinic.

MICHAEL REESE HOSPITAL

PHILIP HALPER. Orthoptics.

RUSH MEDICAL COLLEGE

DR. HOLMES. Orthoptics.

Tuesday Morning

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

GEORGE GUIBOR. Orthoptic training; classification of squint.

SANFORD R. GIFFORD. Concomitant and paralytic squint.

RUSH MEDICAL COLLEGE

DR. WILBER. Histopathology.

Tuesday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

C. V. DEVNEY. Orthoptics.

COLUMBUS HOSPITAL

M. GOLDENBURG. Eye clinic.

COOK COUNTY HOSPITAL

C. F. YERGER. Medical ophthalmology.

ILLINOIS EYE AND EAR INFIRMARY

THOMAS D. ALLEN. Operation for glaucoma and cataract.

LOUIS HOFFMAN and E. K. FINDLAY. Dry clinics.

MERCY HOSPITAL

C. F. SCHAUB and H. C. VORIS. Neuro-ophthalmology: Presentation of cases with fundi, perimetric field findings; discussion of diagnostic problems; presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.

MOUNT SINAI HOSPITAL

J. LEBENSOHN and E. SELINGER. Clinic.

MICHAEL REESE HOSPITAL

T. M. SHAPIRA. Fundus clinic.

RUSH MEDICAL COLLEGE

DR. JACOBSON. Fundus clinic.

ST. LUKE'S HOSPITAL

E. A. VORISEK. Clinical cases.

Wednesday Morning

COOK COUNTY HOSPITAL

SANFORD R. GIFFORD. Retinal detachment.

RUSH MEDICAL COLLEGE

W. F. MONCREIFF. Cataract.

Wednesday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

S. S. BLANKSTEIN. End-results of retinal detachment operations.

CHILDREN'S MEMORIAL HOSPITAL

R. C. GAMBLE and E. A. VORISEK. Diagnostic clinic.

ILLINOIS EYE AND EAR INFIRMARY

DWIGHT C. ORCUTT. Operation for glaucoma and cataract.

S. J. MEYER. Retinal detachment.

K. H. CHAPMAN. Orthoptics.

MERCY HOSPITAL

C. F. SCHAUB, F. I. BARNETT and E. A. ROLING. Fundus clinic.

MICHAEL REESE HOSPITAL

S. J. MEYER and D. SNYDACKER. Retinal detachment clinic.

ST. LUKE'S HOSPITAL

J. WALSH. Clinical cases.

U. S. MARINE HOSPITAL

ALFRED N. MURRAY. Eye injuries.

Thursday Morning

ILLINOIS MASONIC HOSPITAL

ALVA SOWERS. Cataract extraction employing Elschnig technique; discussion of dinitrophenol cataracts—treatment, results.

Thursday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

L. BOTHMAN. Macular disease.

COLUMBUS HOSPITAL

M. GOLDENBURG. Eye clinic.

COOK COUNTY HOSPITAL

E. B. FOWLER. Fundus clinic.

ILLINOIS EYE AND EAR INFIRMARY

E. K. FINDLAY and LOUIS HOFFMAN. Operation for glaucoma and cataract.

THOMAS D. ALLEN. Glaucoma.

MERCY HOSPITAL

C. F. SCHAUB and H. C. VORIS. Neuro-ophthalmology: Presentation of cases with fundi, perimetric field findings; diagnostic problems; presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.

MICHAEL REESE HOSPITAL

JACK COWAN. Glaucoma clinic.

ST. LUKE'S HOSPITAL

FRANK E. BRAWLEY and J. W. CLARK. Clinical cases.

Friday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL

DR. MCSHELLMAN. Cataract results.

CHILDREN'S MEMORIAL HOSPITAL

R. O. RISER. Diagnostic clinic.

ILLINOIS EYE AND EAR INFIRMARY

S. J. MEYER. Operation for glaucoma and cataract.

R. VON DER HEYDT. Slit-lamp demonstration.

RUSH MEDICAL COLLEGE

E. SELINGER. Medical ophthalmology.

ST. LUKE'S HOSPITAL

R. C. GAMBLE. Clinical cases.

Days to be Announced

COLUMBUS HOSPITAL

M. GOLDENBURG. Glaucoma clinic.

HENROTIN HOSPITAL

GEORGE W. MAHONEY, E. A. ROLING and IRVING BARNETT. Eye clinic.

OTOLARYNGOLOGY

Monday Afternoon

ILLINOIS EYE AND EAR INFIRMARY

SAMUEL SALINGER, SIDNEY POLLACK and BERNARD M. COHEN. Plastic surgery of the nose; nasal fractures; nasal and ear prostheses.

RESEARCH AND EDUCATIONAL HOSPITALS

OLIVER E. VAN ALYEA. Surgical anatomy of the nasal sinuses.

MANUEL G. SPIESMAN. Diseases of the pharynx.

SYLVIO A. SCIARETTA. Conservative treatment of chronic suppurative otitis media.

RUSH MEDICAL COLLEGE

LOUIS T. CURRY and FRANK WOJNIAK. Sulfanilamide in the treatment of meningitis.

Tuesday Morning

MOUNT SINAI HOSPITAL

JOSEPH C. BECK, ALFRED LEWY, JACOB LIFSCHUTZ, S. M. MORWITZ, FRANCIS L. LEDERER, M. R. GUTTMAN and associates. Clinics.

MICHAEL REESE HOSPITAL

MAX CUTLER, JEROME E. STRAUSS and SAMUEL PEARLMAN. Radium therapy in malignant tumors of the head and neck, demonstration of cases and technique.

ST. JOSEPH'S HOSPITAL

AUSTIN A. HAYDEN. Conservation of hearing; mastoid and sinus surgery.

Tuesday Afternoon

MICHAEL REESE HOSPITAL

SAMUEL SALINGER and CASPER EPSTEIN. Nasal and facial plastic surgery; treatment of injuries to the face.

RESEARCH AND EDUCATIONAL HOSPITALS

FRANCIS LEDERER. Ear, nose and throat plastic surgery.

PAUL H. HOLINGER. Diseases of the larynx.

RUSH MEDICAL COLLEGE

ELMER HAGENS and PAUL CAMPBELL. Pathology of the petrous bone in cases dying of meningitis; lantern slides.

ST. MARY OF NAZARETH HOSPITAL

J. J. KILLEEN. Mastoiditis in children.

Wednesday Morning

MOUNT SINAI HOSPITAL

JOSEPH C. BECK, ALFRED LEWY, JACOB LIFSCHUTZ, S. M. MORWITZ, FRANCIS LEDERER, M. R. GUTTMAN and associates. Clinics.

ST. ELIZABETH'S HOSPITAL

F. A. DULAK. Ozena.

Wednesday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

J. THEOBALD. Complications of middle ear infections.

SHERMAN L. SHAPIRO. Neuro-otology.

DR. PELOUZE. Deep neck infections.

RUSH MEDICAL COLLEGE

THOMAS W. LEWIS and RICHARD WATKINS. Causative factors and results of treatment of vasomotor rhinitis with foreign protein.

ST. ANNE'S HOSPITAL

JERRY HAYDEN. Ear, nose and throat clinic.

HARRY M. PETERSON. Surgical demonstration and clinic.

Thursday Morning

MOUNT SINAI HOSPITAL

JOSEPH C. BECK, ALFRED LEWY, JACOB LIFSCHUTZ, S. M. MORWITZ, FRANCIS LEDERER, M. R. GUTTMAN and associates. Clinics.

ST. JOSEPH'S HOSPITAL

AUSTIN A. HAYDEN. Conservation of hearing; mastoid and sinus surgery.

Thursday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

NATHAN H. FOX and JOHN W. HARNED, JR. Rhinologic surgery; allergy in relation to otolaryngology.

FRANCIS LEDERER and N. T. PATTENGALE. Cancer of the ear, nose and throat.

RUSH MEDICAL COLLEGE

GEORGE E. SHAMBAUGH, JR. and LINTON WALLNER. The treatment of deafness.

Friday Morning

EVANGELICAL DEACONESS HOSPITAL

JOHN M. BICK. Submucous resection and tonsillectomy.

MOUNT SINAI HOSPITAL

JOSEPH C. BECK, ALFRED LEWY, JACOB LIFSCHUTZ, S. M. MORWITZ, FRANCIS LEDERER, M. R. GUTTMAN and associates. Clinics.

Friday Afternoon

RESEARCH AND EDUCATIONAL HOSPITALS

A. R. HOLLENDER. Physical therapeutic methods.

W. THEOBALD. Nasal accessory sinus disease.

PAUL H. HOLINGER. Bronchoscopy and esophagoscopy.

RUSH MEDICAL COLLEGE

DANIEL B. HAYDEN and E. L. CHAINSKI. Conditions producing tinnitus; evaluation of methods of treatment.

Days to be Announced

BILLINGS MEMORIAL HOSPITAL

J. R. LINDSAY. Petrositis; septic otitis and lateral sinus thrombosis.

CHILDREN'S MEMORIAL HOSPITAL

GEORGE LIVINGSTON, PAUL HOLINGER and associates. Intracranial complications of ear infections; bronchoscopy in children; endoscopic cases.

COOK COUNTY HOSPITAL

I. MUSKAT. Plastic surgery of the nose and face.

S. PEARLMAN. Diseases of the neck and larynx, including laryngoscopy and bronchoscopy.

L. CURRY. Mastoiditis and meningitis.

A. LEWY. The mastoid and the labyrinth.

T. C. GALLOWAY and H. E. DAVIS. Selective treatment in malignancy about the head.

ILLINOIS EYE AND EAR INFIRMARY

ALFRED LEWY. Chronic suppurative otitis media.

JOHN CAVANAUGH. Chronic sinusitis; diagnosis and surgical treatment.

Fig. 1. Gross appearance of recurring myxomatous cysts of the corium as seen on a toe and finger. The cyst on the toe had reformed after previous surgical extirpation (Case 2). The cyst of the finger was of 2½ months' duration (Case 3). The cross section of the lesion which was excised from the finger shown above. The cyst had a well defined cavity, lying wholly within the derma, and was filled with a clear, syrupy, mucoid fluid. ×10

Recurring Myxomatous, Cutaneous Cysts of the Fingers and Toes.—Robert E. Gross